PRINCIPLES of PLANNING SMALL HOUSES

Joseph G. Nucci, RA
Senior Planner/Historic Preservation Officer
Community Development Department

(480) 350-8870
(480) 350-8579 Fax
(480) 350-8913 TDD
(480) 968-0463 Res
joe_nucci@tempe.gov
www.tempe.gov/historicpres

City of Tempe
21 East Sixth Street, Suite 208, Tempe, Arizona 85281

NATIONAL HOUSING AGENCY
FEDERAL HOUSING ADMINISTRATION
TECHNICAL BULLETIN NO. 4
Revised June 1, 1946

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FOREWORD

This revised edition of Principles of Planning Small Houses is presented to stimulate and encourage the designing of homes at reduced cost without sacrificing comfort and convenience, or sound construction and reasonable maintenance expense. As heretofore, the Federal Housing Administration advocates reducing building costs by effecting space economy rather than by cheapening the construction through the use of short-lived, inferior materials.

Skill is essential to the development of small, compact plan arrangements, wherein all of the space must be utilized to fullest advantage without the effect of crowding. Unusual ability is also required to bring simplicity, harmony and refinement to the exterior design of the small house. It is recommended to those who contemplate building at a minimum of expense, that the designs of the house and appurtenances be the product of competent and experienced architectural talent.

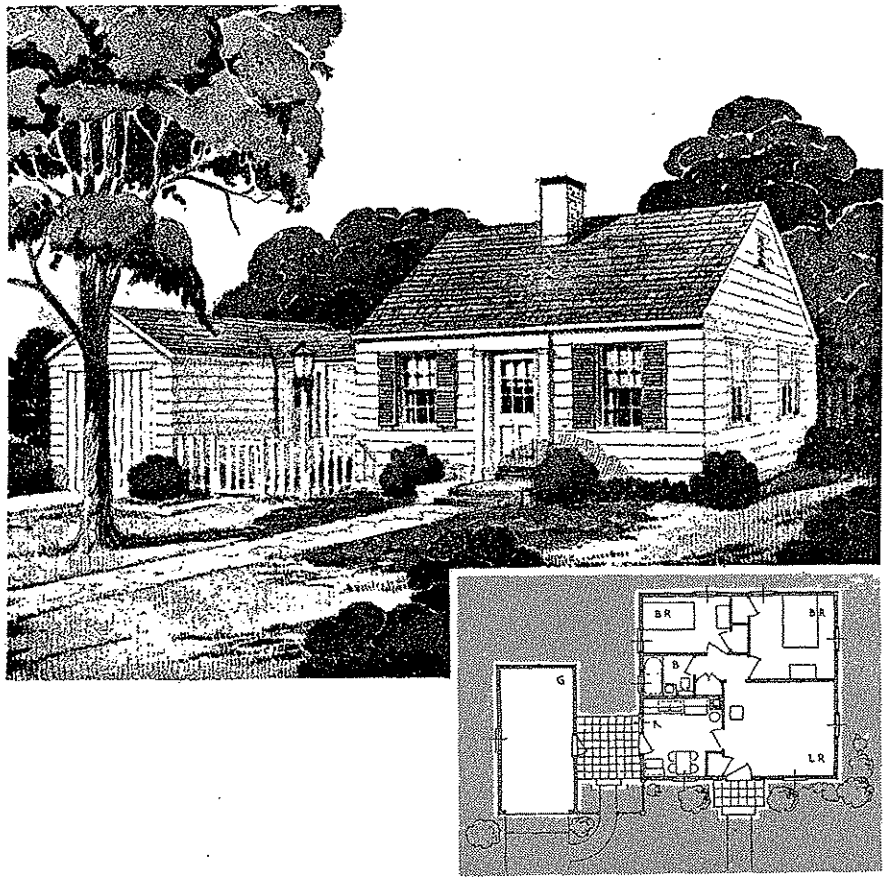
In the suggested plans illustrating the text of this booklet, space economy is accomplished through the compact arrangement of rooms which meet or approach the minimum sizes generally considered essential. Local preferences, which vary from one part of the country to another with respect to room sizes, storage facilities, and other matters of plan arrangement, are reflected in the FHA planning requirements for the different states and districts. Because of these variations, no dimensions or other details have been indicated for the plan arrangements shown herein. For the same reason, minor modifications may be required to effect compliance with local FHA requirements.

As presented herein, these plans have not been sufficiently developed to serve as drawings from which to build, or as exhibits for submission to the Federal Housing Administration in connection with applications for mortgage insurance. Information respecting the requirement for such exhibits should be obtained from the local FHA field office.

NATIONAL HOUSING AGENCY

FEDERAL HOUSING ADMINISTRATION

WASHINGTON, D. C.



The small house can be planned to provide ample living comfort and convenience by the compact arrangement of space. Connecting the garage to the house by a covered passage provides a useful service porch and increases the apparent size. The exterior design, reflecting simplicity, harmony and refinement, attractively expresses the interior plan arrangement.

PLANNING THE SMALL HOUSE

for Livability and Low Cost

HOUSES are family living units consisting of many elements combined to produce safe, sanitary, comfortable, and convenient living accommodations. Houses vary in size and in number of rooms due to family needs and with the cost for which they must be built. Cost limitations also have a bearing on the quality, equipment, and various refinements that can be incorporated. Many desirable features of houses, however, are not dependent upon size or cost, but upon the skill of the designer.

In a well-designed house the various elements of which it is composed are balanced in quality, quantity, and cost and so combined that they result in a satisfactory shelter unit. The necessity of well-balanced design is especially evident in the small house of low cost. Here a **maximum** amount of usable space, with as much comfort, convenience, and privacy as possible, must be obtained for a **minimum** amount of money. To achieve this objective, construction, equipment, and room arrangement must be related and considered together to avoid excesses in one or more directions at the expense of inadequacy in others. The starting point of balanced design is the plan, for it is here that all essential elements of a house are brought together and are coordinated.

Experience has demonstrated that the planning of well-designed, livable houses that can be built economically is based upon a few fundamental principles. These principles of planning can be broadly grouped as those which affect livability and privacy, exterior and interior appearance, and construction cost. Many of the principles overlap and are interdependent, and to reconcile conflicting demands for space, livability, appearance and low cost, compromises must be made. The purpose of this booklet is to show how these principles may be applied to a few basic plans and the plans adjusted or varied to meet individual requirements, desires or conditions.

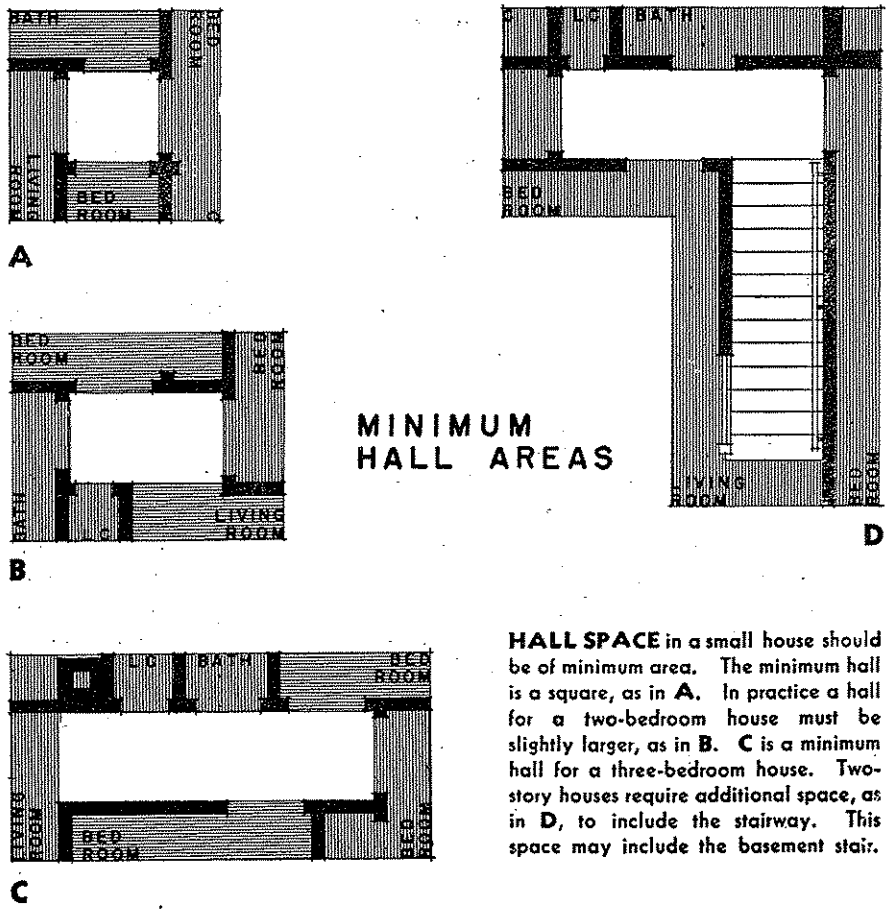
PLANNING FOR LIVABILITY

To obtain a maximum amount of livability and privacy within a minimum area is a major problem in planning low-cost houses. Livability of any house is dependent upon adequacy of room areas, relationship of rooms to afford privacy, circulation within and between rooms, room exposures, and equipment that provide for the convenience and comfort of the occupants. Economy in planning requires the elimination of waste space, especially hall areas; rooms planned for dual purposes when possible; and rooms whose shape and wall space permit the use and arrangement of essential movable furniture in a minimum floor area. Economy in planning also is related to the structural elements of the house and the installation of the mechanical equipment, especially that of heating and plumbing.

As to function or use, the rooms in a house can be placed in two general groups, living and sleeping. Living use includes cooking, dining, and the various family activities associated with the living room. In its most elementary form the living area may combine cooking, dining, and living in one room, a practice at one time common to the early American farmhouse. In more pretentious houses these functions were and still are placed in separate rooms. In the small low-cost house it is possible to effect a compromise in the interest of space economy and combine the dining function with either that of cooking or of living. It is a logical compromise, since dining space is required for use for only about three hours each day.

Preference for dining space in the kitchen or the living room varies with individual families. When the kitchen is used also for dining purposes, it should be made somewhat larger than for kitchen use alone. By correct planning of equipment, placing the kitchen in a corner for two exposures and proper orientation, and care in selecting wall decoration, this room may be made attractive and livable. When properly planned and ventilated, objection to eating in the kitchen is largely removed.

For those who prefer to dine in the living room, the kitchen can be made small but adequate for equipment and work space. Space provision should be made in the living room for the dining table and chairs or for table, chairs, and wall seat in a location as convenient as possible to the kitchen. This increases the area of the minimum living room, but requires less floor area than separate dining and living rooms. Space economy is often obtained by planning the

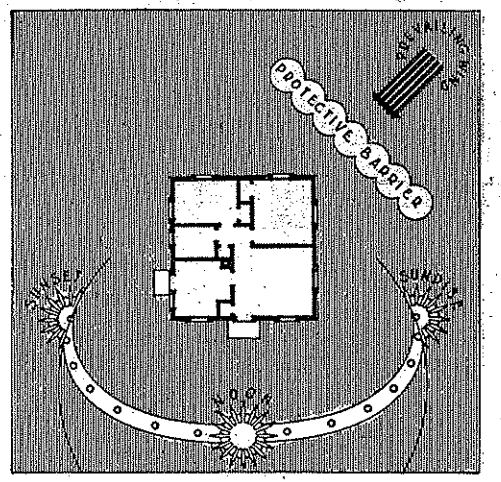


HALL SPACE in a small house should be of minimum area. The minimum hall is a square, as in **A**. In practice a hall for a two-bedroom house must be slightly larger, as in **B**. **C** is a minimum hall for a three-bedroom house. Two-story houses require additional space, as in **D**, to include the stairway. This space may include the basement stair.

dining space in a corner, usually near a window. By care in selection of furnishings, the dining furniture can harmonize with the living room furniture and can be readily converted to living room use when not used for dining. When so planned, objection to dining in the living room is minimized.

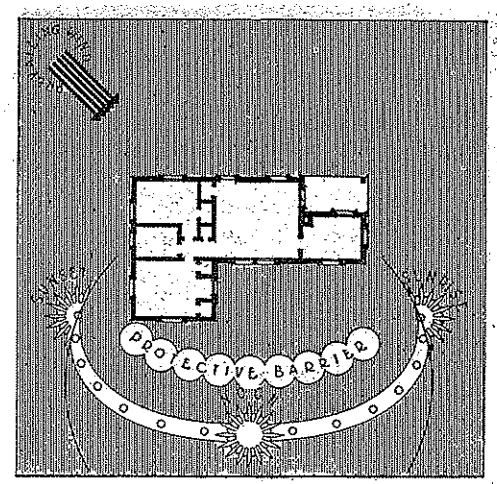
When cost permits additional space, an alcove for dining may be economically planned in conjunction with the living room and adjacent to the kitchen. For maximum economy the alcove should not be larger than necessary to accommodate essential furniture. At additional cost the space may be increased and may be made into a separate dining room.

IN THE NORTH houses are usually built with a compact plan for economy and comfort in winter weather. Living rooms should be located to receive as much sunlight as possible. Protection should be provided against cold prevailing winter winds. This protective barrier, among others, may be buildings, trees or glazed storm sash.



Insofar as possible, rooms used for sleeping should be well separated from the balance of the house. In general, they should be located in corners to provide for two exposures to obtain cross ventilation. Their size need only be sufficient to accommodate essential furniture consisting of bed, dresser and one or two chairs and provide space to permit easy access to the furniture and closet. Bedroom space should be at least sufficient for a double bed. However, when a house contains three or more bedrooms, one may be the main bedroom and the others may be made smaller if necessary.

Economy in the area of sleeping rooms, as well as improvement in their convenience is obtained by correct location of door and window openings to obtain maximum wall space for furniture. The shape of these rooms and the relationship of wall openings and wall spaces should permit an arrangement of furniture which does not require walking around a bed in order to reach the bedroom entrance door, closet, and dresser. Convenience in use of this room is improved when the dresser and closet are reasonably close together. Convenience in housekeeping results when there is sufficient space to permit the bed to be made from two sides. If possible, wall space and window openings should be such that a window does not occur immediately over a bed. When this cannot be avoided, the window location should be as near the foot of the bed as possible to minimize cross drafts on the bed. The use of corner windows will often solve this problem and provide more effective wall space.

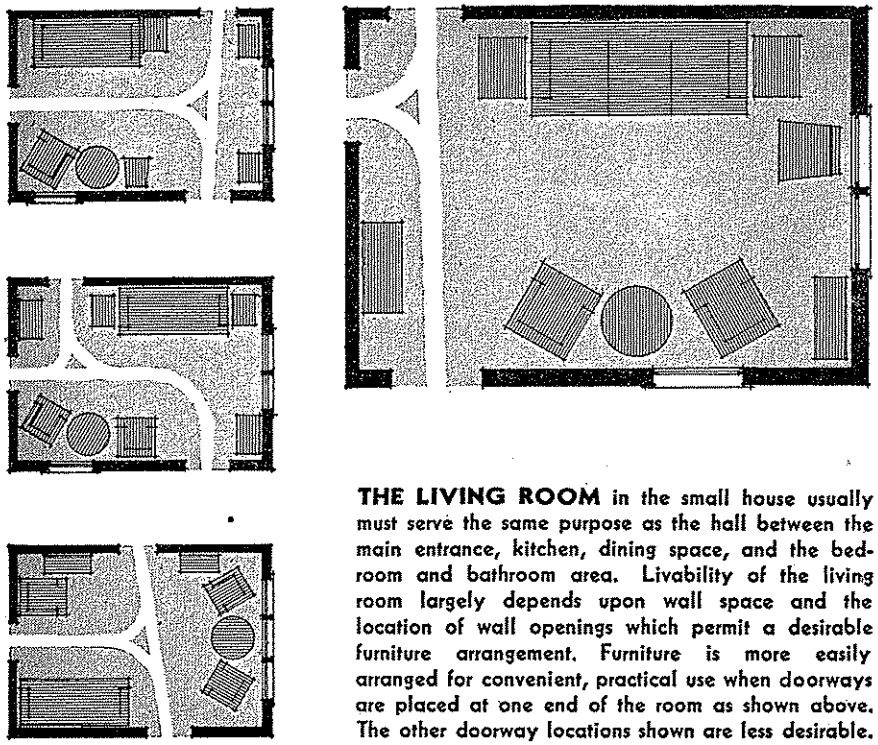


IN THE SOUTH cross ventilation of rooms is more important for livability than a compact plan. Houses should be designed and located to take advantage of the prevailing summer winds common to their locality. Desirable protection from the sun may be obtained through the use of trees, window blinds, awnings, or other means.

Each bedroom should be provided with a closet of economical shape. A closet at least 24 inches deep is more useful, provides more space for hanging clothes with minimum area than a deeper closet. A small closet preferably in a hall accessible to the bedrooms and bathroom should be included for linen storage. The bathroom should be easily accessible to all bedrooms and located for maximum privacy.

Hall space is necessary to afford privacy and communication between various rooms, especially between living room, bedrooms and bathroom. Except for privacy and access, it is not usable space and for economy it should not be larger than necessary. In its minimum form the hall is approximately a square with door openings on its four sides permitting access to the same number of rooms. The minimum hall is thus limited to the one-story, two-bedroom house. Additional bedrooms or the use of two stories require increased hall area, which should be planned for minimum size.

Reduction of hall space to a minimum results in a house of compact plan and the use of the living room as a passageway between the entrance, kitchen, and the bedroom-bathroom hall. The use of living space also as a passageway can be accomplished without destroying its more important use for rest, relaxation, and as a center of family life, only by care in the location of doors in the living room. For convenient passage, space must be preserved free from furni-



THE LIVING ROOM in the small house usually must serve the same purpose as the hall between the main entrance, kitchen, dining space, and the bedroom and bathroom area. Livability of the living room largely depends upon wall space and the location of wall openings which permit a desirable furniture arrangement. Furniture is more easily arranged for convenient, practical use when doorways are placed at one end of the room as shown above. The other doorway locations shown are less desirable.

ture. When doors leading to rooms between which there is frequent communication are placed diagonally opposite, the placement of furniture for greatest use and convenience is made difficult or impossible. The livability of the house is then greatly reduced. This can be avoided at the time the house is planned by locating doors in adjacent walls and as near the corners as possible, or an arrangement of doors which permits use of one end of the room for circulation purposes.

The livability of houses, without adding to their cost, is improved by correct location of rooms with respect to sunlight, prevailing winds, and view. The living room should be placed so that it receives as much sunlight as possible. This adds to the comfort, warmth and cheerfulness of the room as a place in which to live. The best view from the house should be from the living-room windows unless this interferes with other major considerations.

Since cooking operations add to the warmth of the kitchen, it is advisable to locate the kitchen to afford maximum protection from the additional heat of the sun. This can usually be accomplished by placing the kitchen to the north or northeast. Bedrooms should receive sunlight at some time during the day and, if possible, be favored by exposure to the prevailing winds.

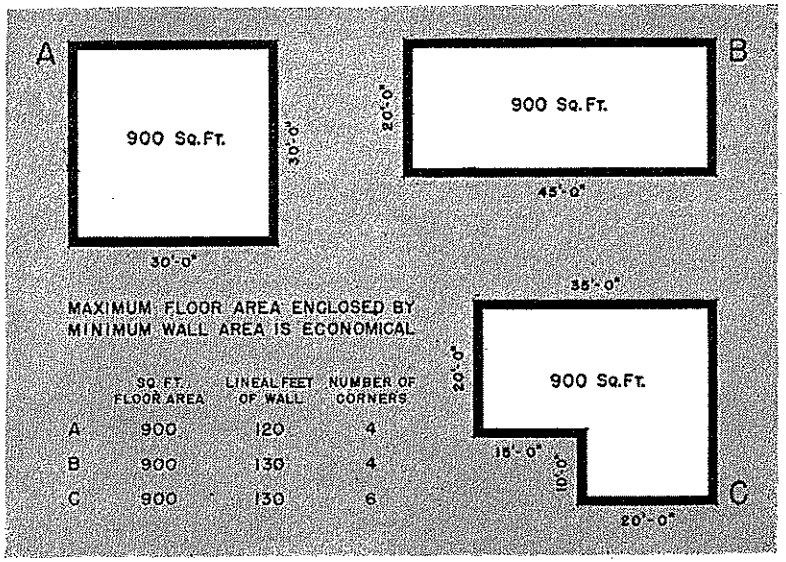
The plan of houses and room exposures with respect to livability are influenced by geographic location. In localities where winters are long and severe, a compact plan and low ceilings are desirable to permit ease of heating with economy. In such locations full advantage of the radiant heat of the sun is desirable in as many rooms as possible, as well as some form of protection from cold winds. In a warm climate the opposite is required, and less compact plans are needed in order to take advantage of prevailing breezes and to secure cross and through ventilation in as many rooms as possible. Here protection from the heat of the sun is essential and the most desirable rooms are those which are cool and shaded.

The correct placing of the house on the site to obtain desirable sunlight and the benefit of or protection from prevailing winds can normally be done with any small-house plan. If necessary to obtain the most desirable relationship of rooms to natural conditions, the same plan can be revolved about its center line or reversed and revolved. This seldom requires change in the plan beyond the possible relocation of the entrance door and possibly the kitchen or service entrance and change in location of windows in these rooms. When planned for, this factor in livability adds nothing to the cost of the house.

BASEMENT OR UTILITY ROOM

In its most elementary and most economical form, a house has neither basement nor utility room. Whether a house is to be planned without a basement, or with a full or partial basement, or with a utility room on the first floor involves questions of personal preference, local need and custom, type of heating plant to be used, space requirements for laundering and for general storage, and the cost of construction.

Personal preference, in the case of small houses, usually is not a deciding factor. It may often happen that preference for the convenience of a first floor utility room will also permit the use of the type of heating plant desired or required. It also may be possible to build a utility room as economically or more so than a basement. From a practical aspect the method of heating the house and cost of construction of a basement or a utility room are the important factors to be considered.



THE THREE HOUSES ABOVE have the same floor area. House **B** would be more costly to build than house **A** due to its additional ten lineal feet of wall. If this were a one-story and basement house, it would have about 165 more square feet of foundation and exterior wall area than house **A**. The cost of house **C**, which has the same exterior wall area as house **B**, would be increased by the added cost of two exterior corners, and would cost much more than house **A**.

Where neither basement nor utility room is included in the plan, if heating is required, it is necessary to use one or more stoves, circulating space heaters or floor furnaces. If a basement or partial basement is planned, the heating system may be hot water or steam or warm air of the pipeless, gravity, or forced circulation type. When a utility room on the first floor is used, forced hot water or forced warm air may be used as the method of heating.

Construction cost is influenced by the extent to which space for household utilities increases the ground area of the house and by the cost of enclosing the utility space. A basement does not increase the ground area of a one-story house when access to the basement is by outside cellar steps, nor does it decrease the useful area on the first floor. When an inside basement stair is used the required ground area of a one-story house with an inside basement stairway will be increased unless room sizes are reduced to compensate for the floor

Continued on page 30

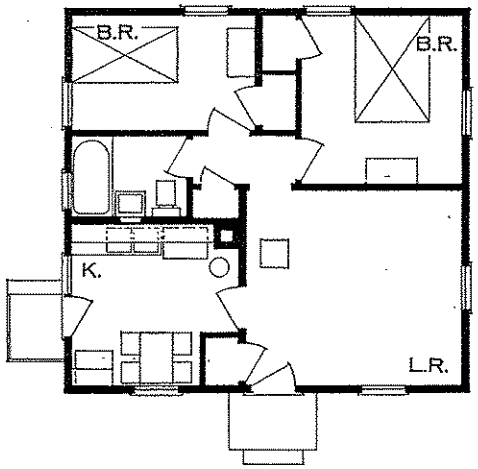
THE APPLICATION OF PLANNING PRINCIPLES

is demonstrated in the basic or fundamental small-house plans shown on the following pages. These plan schemes contain the elements of convenient, comfortable houses which combine the essentials of livability and privacy with minimum areas. The plans have been developed with the shape of the house, coordination of mechanical equipment, and simplicity of structural framing viewed as of equal importance to livability.

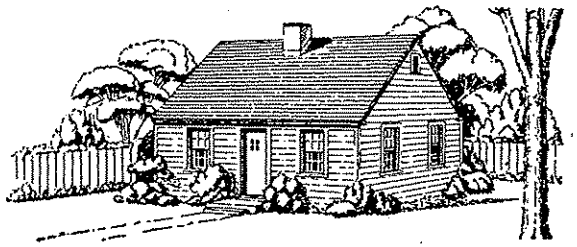
The plans are illustrations of planning principles. For construction use any of the plans must be modified to meet individual requirements due to location and market demand. Market demand in this instance refers to the type of houses a large number of people desire to own and live in. The type of house, number of rooms, equipment, exterior design, materials, and other items are subject to wide variations. For this reason any of the plans shown in this booklet must be adjusted to meet the needs of different localities and price ranges.

Progressive steps in the planning of small houses are illustrated from pages 12 to 29, inclusive. These begin with a simple basic plan for a one-story, two-bedroom house in which livability and cost have been viewed as primary considerations.

By progressive stages the basic plan is improved in its livability by the addition of a basement or utility room, dining space combined with or separated from other areas, and by the ultimate development of a two-story house with attached garage. Variations of each planning stage are suggested to indicate other possible solutions than those shown. Room sizes, which are subject to variation, have been omitted since the purpose of this booklet is to illustrate, by means of basic room arrangements, the principles of planning small houses.

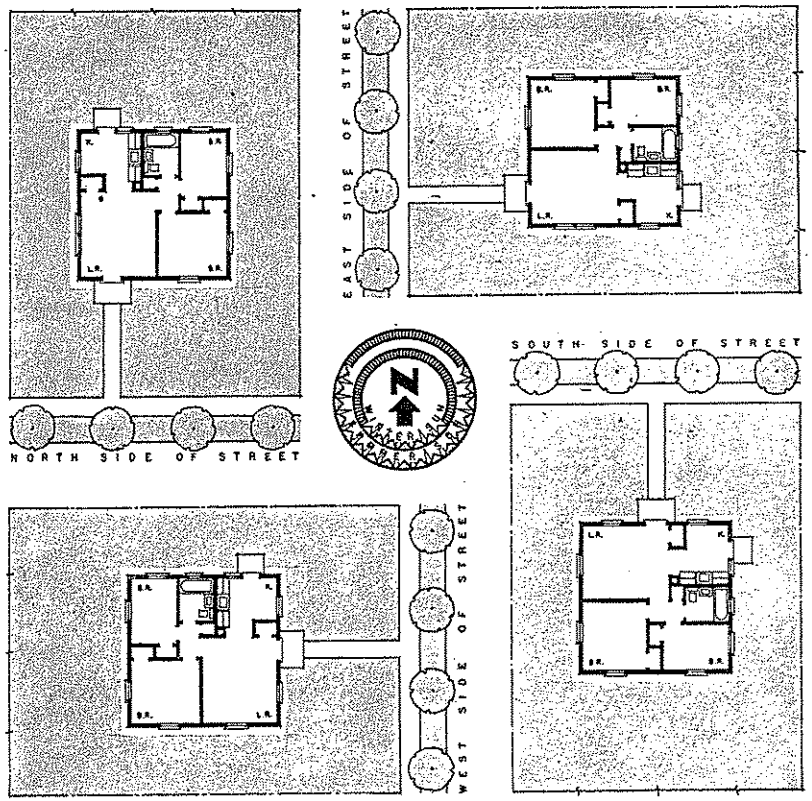


L. R. LIVING ROOM
B. R. BEDROOM
K. KITCHEN



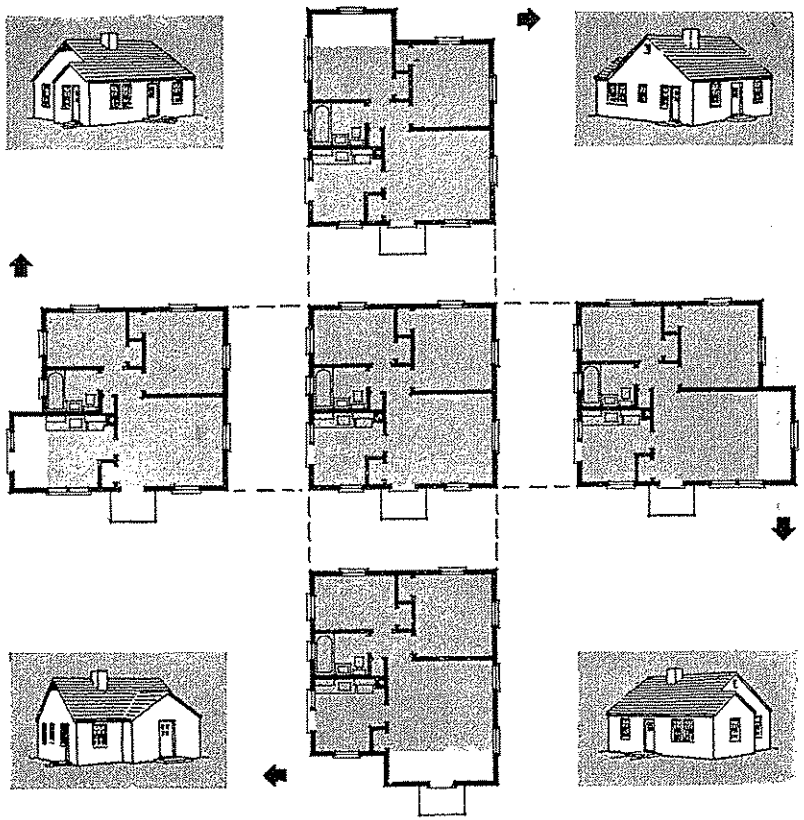
LIVABILITY in this basic small house is assured by separation of sleeping and living areas; privacy obtained with a minimum hall; adequate closet space; and a kitchen which provides space for dining. Room sizes are based upon the use of framing materials of standard length. Economy in construction is assured by the square plan providing maximum floor area with minimum wall area; location of bathroom and kitchen to permit concentration of plumbing pipes; use of an inside chimney for heater and kitchen range; omission of basement to minimize excavation and foundations; and use of simple structural framing and stock millwork. Use of a space heater permits minimum cost and floor area for heating equipment. This plan serves as a starting point from which the variations shown on pages 16 to 19 can be added.

BASIC PLAN
ONE-STORY
TWO-BEDROOMS



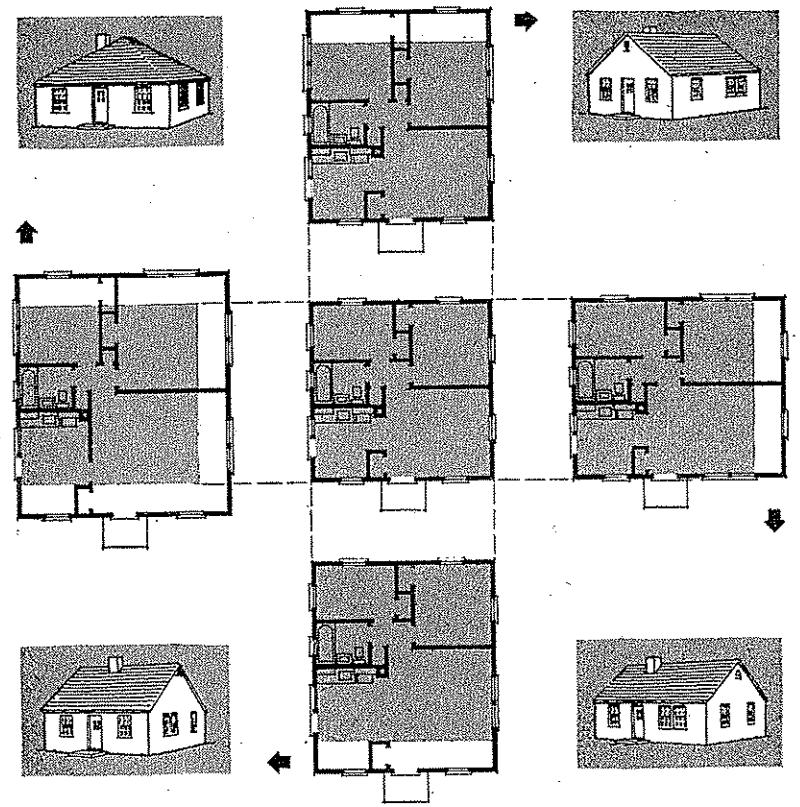
ORIENTATION of a house is an important factor affecting its livability. This planning principle concerns the relationship of rooms to sunlight, prevailing winds and view. The living room should be bright, cheerful, have plenty of sunlight and the best view from its windows if possible. Morning sunlight generally is desirable in the dining space and the kitchen should be located to avoid the heat of afternoon sun. Bedrooms should have sunlight some time during the day. Geographical location has a bearing on orientation as well as the plan. Any compact plan can be correctly orientated by rotating the plan or reversing it, when necessary, as shown by the above use of the basic two-bedroom plan for sites on different sides of the street. The only change in plan required is the relocation of the entrance door and living room windows.

ORIENTATION



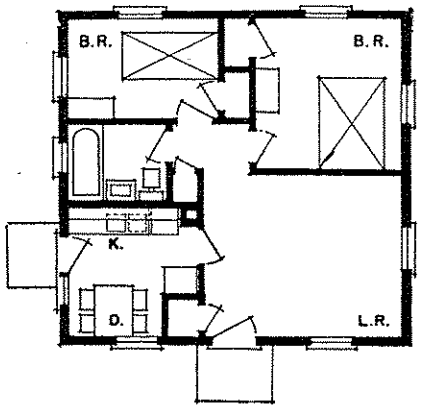
INDIVIDUAL ROOMS of the basic house shown on page 12 may be increased in area by adding to their width or length. This changes the shape of the house and increases the cost of labor and materials required for foundations, floors, ceilings, walls, and roof. The projection adds at least two corners, which combined with the increased area of the house, add to the cost of the basic house. The costs of plumbing, doors and windows are not necessarily increased. Exterior projections, while increasing the cost, do permit variations in exterior appearance not obtained with square or rectangular houses. As shown in the illustration, the increase in area of any room has not destroyed the primary relationship of the rooms and the inherent livability and economy of the basic plan arrangement.

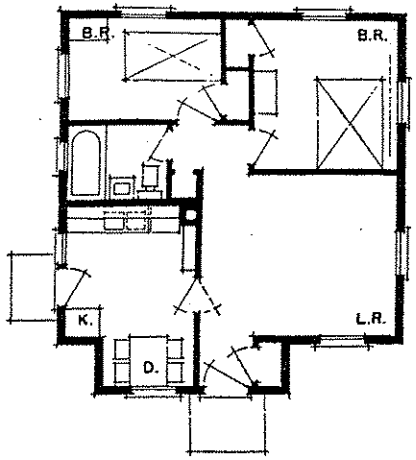
AREA INCREASED IN ONE ROOM



INCREASE IN AREA of the basic house plan can be obtained by enlarging the plan to the rear, side or front. Increasing the depth of the house, front or rear only, increases the area of two bedrooms or the living room and kitchen. When the width is increased, the area of one bedroom and the living room is increased. The increase in size also may be in two or three directions, thus increasing the area of all rooms. These increases in area add to the cost of foundations, floor, ceiling, walls, and roof. For economy, the increases in area should be obtained by increasing the number of joists and not require additional joist length, girders or bearing walls. Economical variations in the exterior of square and rectangular houses are possible within reasonable limitations and as cost permits.

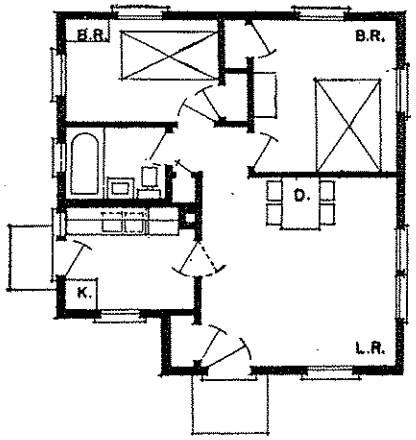
AREA INCREASED IN TWO OR MORE ROOMS

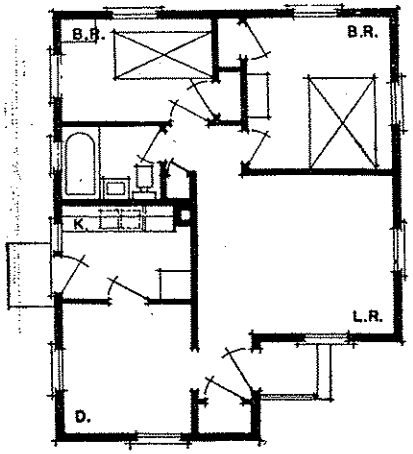




SPACE FOR DINING is required for about three hours each day. Economy in floor area is obtained by using the kitchen or the living room also for dining. When dining space is combined with the kitchen, the minimum kitchen area must be increased to provide for the dining table and chairs or seats. Two plan variations are shown which permit use of the kitchen for the dual purpose of dining and cooking, one maintains the economy of the square house, the other suggests a dining alcove and exterior projection. Other variations are possible as determined by cost, personal preference and the skill of the designer. The combined dining and cooking room can be arranged, ventilated and decorated to be attractive and livable.

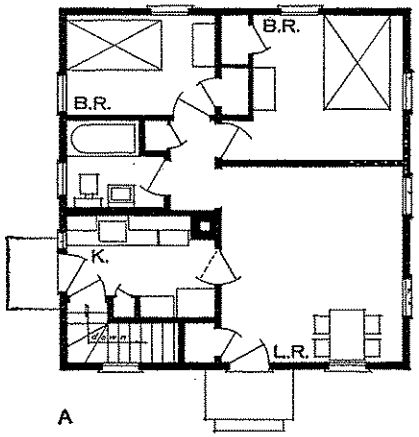
ONE-STORY COMBINED DINING-COOKING



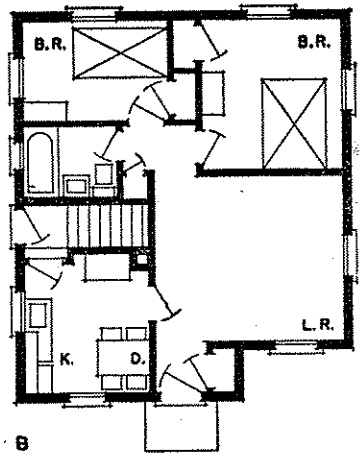


LIVING ROOM DINING SPACE is preferred by some families. In this case, the size of the kitchen can be a minimum consistent with its use and the living room of sufficient size for dual purposes. Space convenient to the kitchen should be reserved for dining table and chairs or a corner seat, table and chairs. The plans suggest one method of combining living and dining space as well as the use of a separate dining room. The separate dining room adds to the cost of the basic house plan through increased area and additional partitions. Care in furniture selection is important to maintain the livable qualities of a dual-purpose room. The dining furniture should harmonize with the living room furniture.

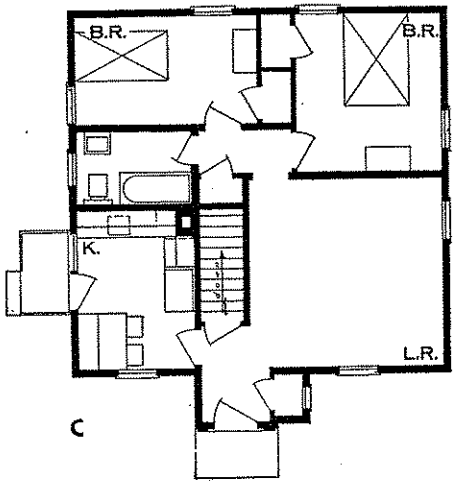
ONE-STORY SEPARATE DINING-COOKING



A



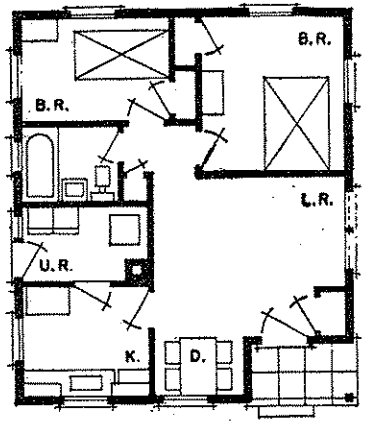
B



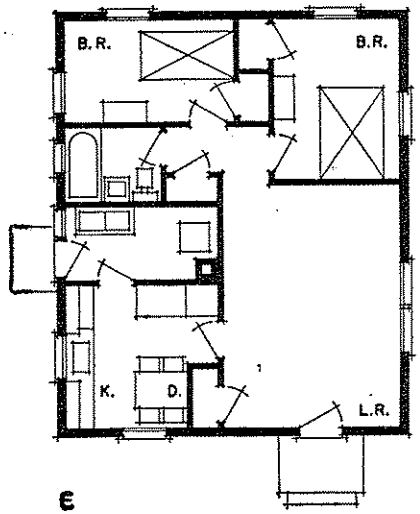
C

A BASEMENT introduces a new planning element in the basic plan—a basement stairway. This stairway, closely related to the kitchen, may logically connect with this room. Placing the stairway in a corner as in **A** prevents desirable cross ventilation in the kitchen and reduces its window area. Location of the stairway between the kitchen and the bathroom as in **B** prevents placing plumbing fixtures on a common partition. This increases the cost of the plumbing installation which, however, may be a minor consideration. The objections to the arrangements shown in **A** and **B** are overcome by placing the stairway between the kitchen and the living room as in **C**.

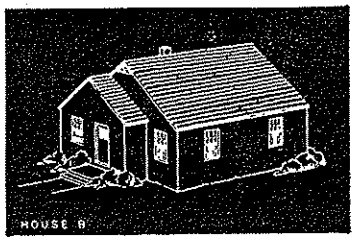
ONE-STORY UTILITIES IN BASEMENT

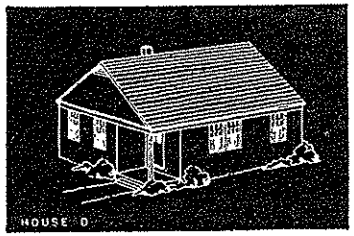


D



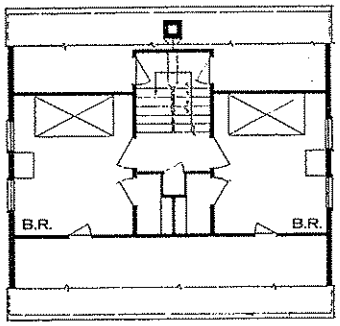
E



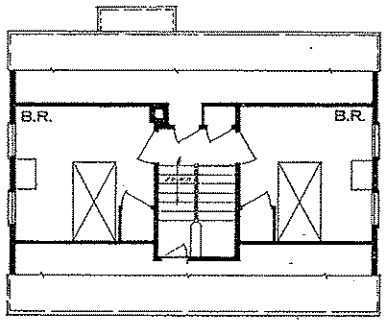


FIRST FLOOR UTILITY ROOMS add to household convenience and are often economical to build. A minimum size utility room requires slightly more floor area than a basement stairway. Placing this room between the kitchen and the bathroom concentrates the plumbing installation and permits location of the kitchen in a corner for cross ventilation. The use of a basement or a utility room improves the basic plan shown on page 12 by providing separate space for heating equipment. Plans **D** and **E** show two variations which include a utility room and dining space in kitchen or living room alcove. Other variations are possible and often desirable.

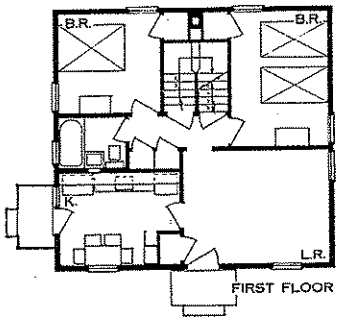
ONE-STORY UTILITIES ON FIRST FLOOR



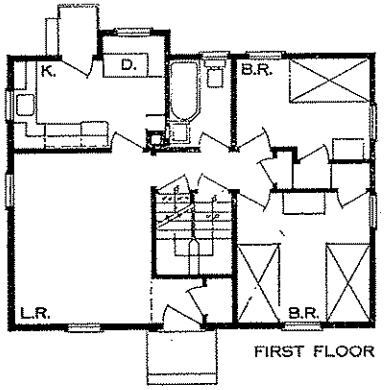
SECOND FLOOR



SECOND FLOOR



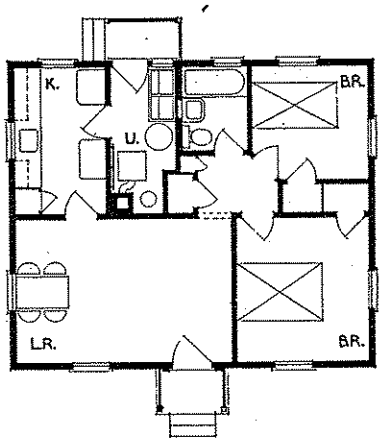
FIRST FLOOR

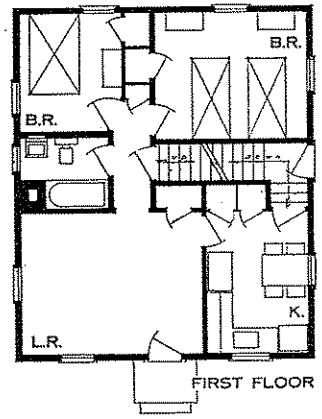


FIRST FLOOR

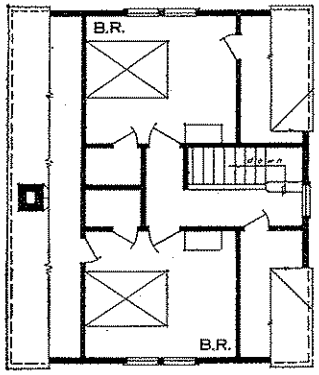
ADDITIONAL BEDROOMS in the attic can be planned for in the small house by including a stairway so located that privacy is maintained between the first and second story bedrooms and the bathroom. The stairway also may provide access to a basement. The stairway increases the floor area beyond that of the two-bedroom basic house plan on page 12. The second story bedrooms may be finished at the time the house is built or at some future time. The plan may combine space for cooking and dining, living and dining, or separate rooms may be used.

VERTICAL EXPANSION ONE AND ONE-HALF STORY





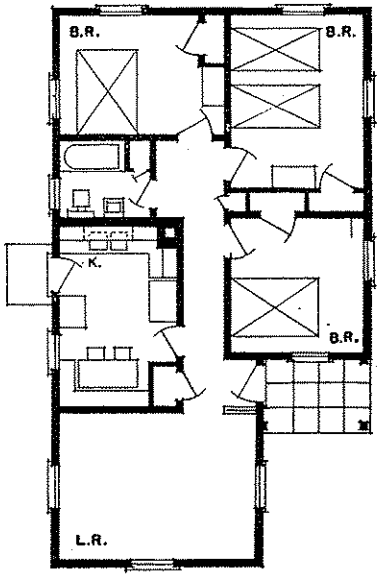
FIRST FLOOR

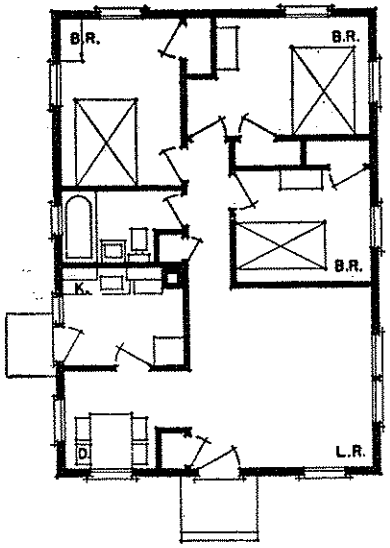


SECOND FLOOR

VARIATION OF THE TWO-BEDROOM basic scheme may include a laundry-utility room on the first floor as shown in the plan at the top of the page. The lower plan shows another variation of the basic scheme with a stairway to the attic where two bedrooms may be finished later. Note that the stairway to the attic starts in the bedroom-bathroom hall and that privacy is not sacrificed when the future bedrooms are completed. The stairway to the grade level service door and to the basement is conveniently entered from the kitchen.

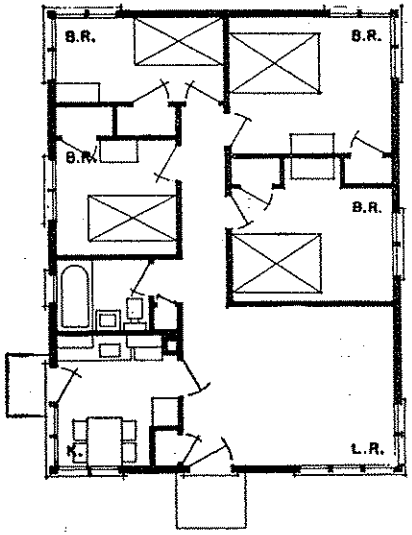
UTILITY ROOM, BASEMENT AND VERTICAL EXPANSION

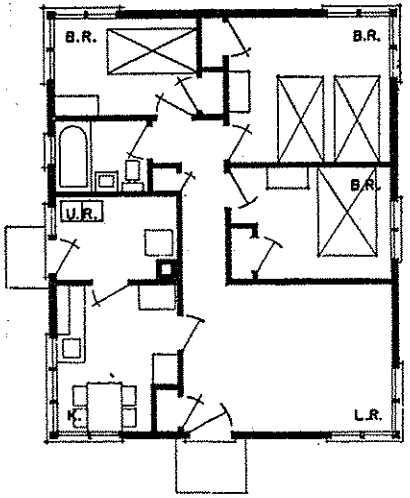




THREE-BEDROOM HOUSES also may have compact economical plans based upon the same planning principles as those demonstrated in the two-bedroom house. The bathroom-kitchen back-to-back arrangement can be maintained for economy in the plumbing installation. The hall required for circulation and privacy should be of minimum area. Where three bedrooms are provided, the living room should be increased in size. In many localities two-story houses are more economical when 3 or 4 bedrooms are required.

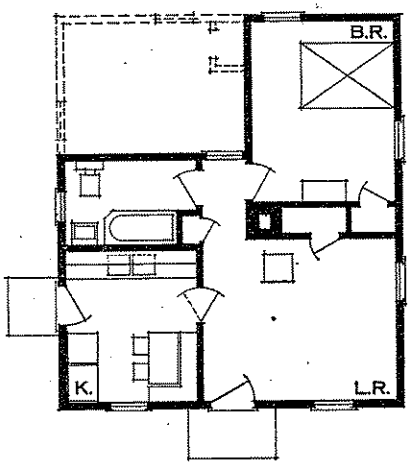
ONE-STORY THREE BEDROOMS

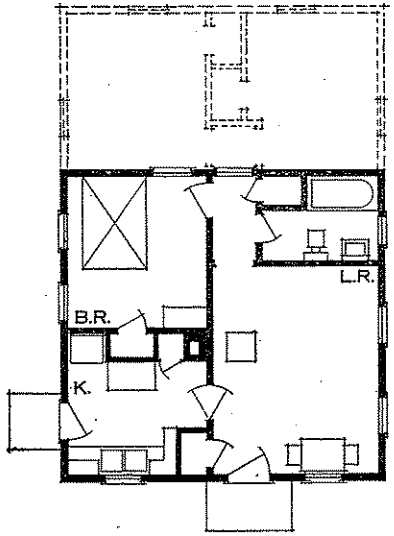


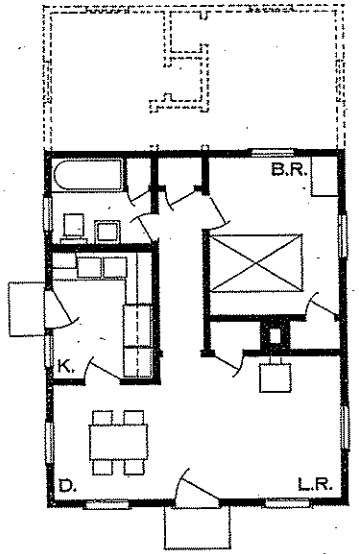


PRINCIPLES OF PLANNING which effect livability, privacy, construction, and space economies may be applied to both three- and four-bedroom houses. The plans shown may be varied in their room arrangement and use of a basement stairway or utility room as previously suggested. With changes in shape and size of the house a large number of solutions are possible which conform to the principles outlined. The plan of the four-bedroom house shown above is better adapted to southern than northern locations.

ONE-STORY THREE AND FOUR BEDROOMS

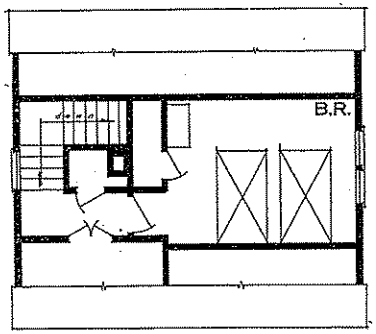




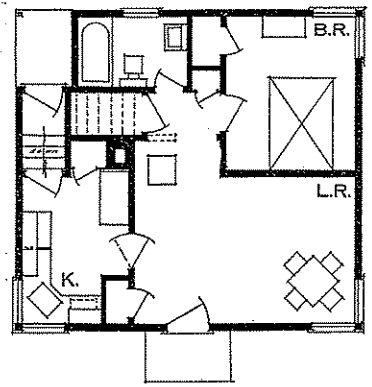


ONE-STORY
ONE-BEDROOM
PLANNED FOR EXPANSION

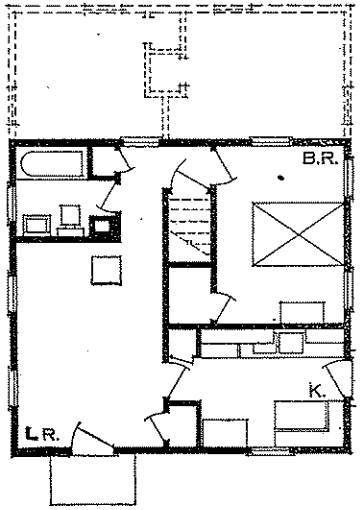
ONE-BEDROOM HOUSES planned for the addition of one or two bedrooms on the first floor. In its basic form the one-bedroom house provides complete living accommodations for a small family in the minimum of area. The expansion is planned so as to maintain the privacy of the bedroom-bathroom area and does not seriously impair the light and ventilation in the original part of the house. The expanded plan retains the rectangular shape for economy in construction. Dining space is provided in the kitchen or living room in the plans above and in a separate alcove off the living room in the plan at the left. The doors into the future bedrooms should be framed in when the first part of the house is constructed.

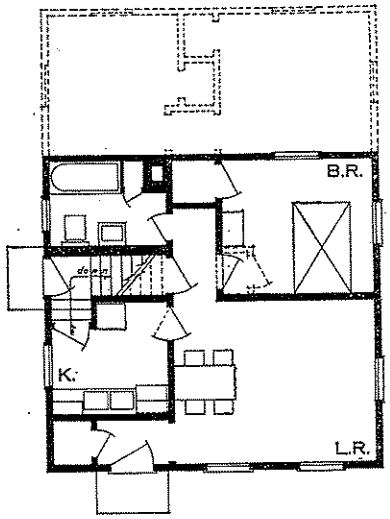


SECOND FLOOR



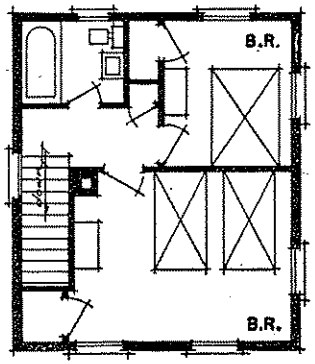
FIRST FLOOR



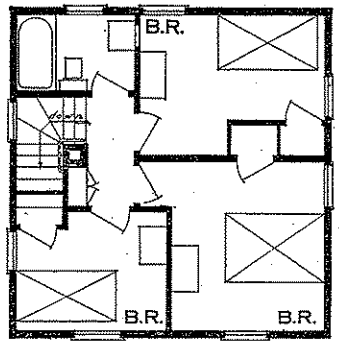


ONE-BEDROOM HOUSES may be planned for vertical expansion. The house plan above provides space for a stairway to the attic which may be installed during the original construction or later. If a basement is desired the same space may be used for the basement stairs leading down from the service door landing. The second-floor plan suggests a method of developing the attic area to provide one bedroom. The house plans at the right are susceptible to expansion either vertically or horizontally. The upper plan is basementless while lower envisages laundry, storage, and heating facilities in the basement.

ONE-STORY
ONE-BEDROOM
VERTICAL EXPANSION



SECOND FLOOR



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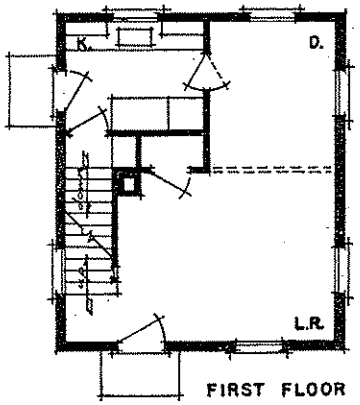
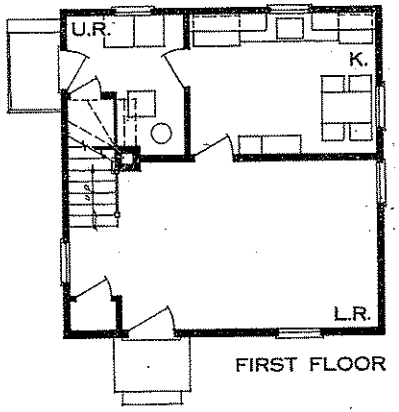


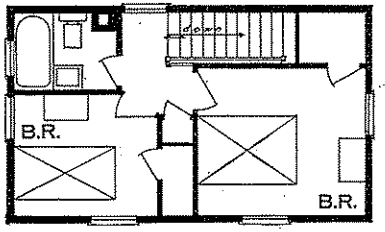
FIRST FLOOR



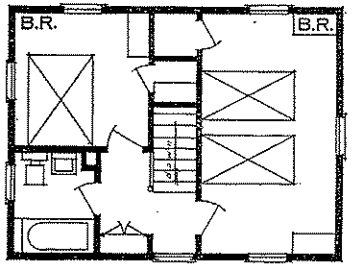
FIRST FLOOR

SIDEWALL-STAIR PLANS are frequently used for two-story houses and are economical in stair and hall space. The plans shown illustrate two first and second floor variations that result in simple houses of compact plan. In both, livability, privacy and comfort have been preserved. From these simple basic plans, one may progress to larger and more elaborate schemes to meet family requirements, limited only by the cost of construction and equipment.

TWO-STORY
2 AND 3 BEDROOMS
SIDE-WALL STAIR



SECOND FLOOR



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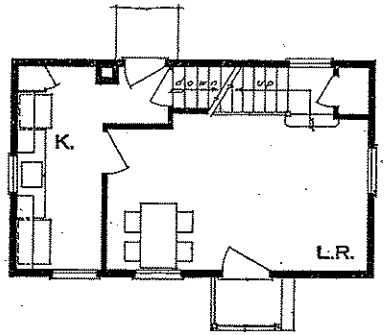
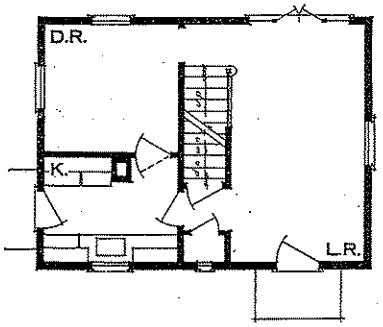


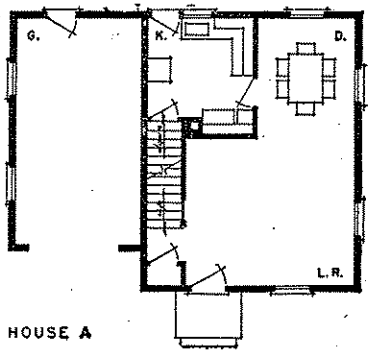
FIRST FLOOR



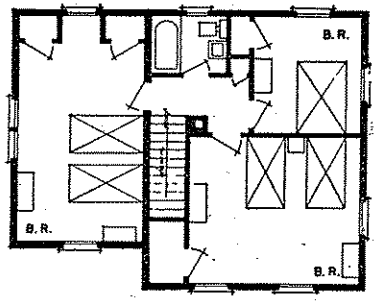
FIRST FLOOR

TWO-STORY, TWO-BEDROOM plans may be varied by locating the stairway at the rear wall or on a center hall. The house plan on the left is an economical arrangement for a minimum two-bedroom house and one that is suitable for a relatively short lot. This house may be framed with a single span of floor joists, front to back. The house plan on the right assumes a garden to the rear and provides access to it from the living room for outdoor living. The kitchen is conveniently located with respect to the front door without sacrificing ease of access to the service entrance and basement.

TWO-STORY
TWO BEDROOMS

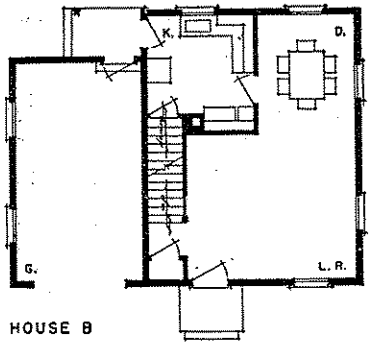


HOUSE A

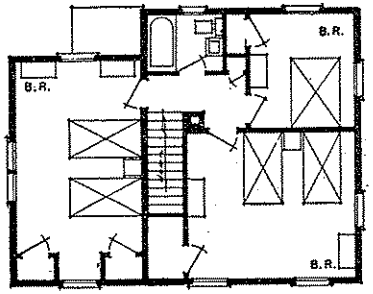


HOUSE A

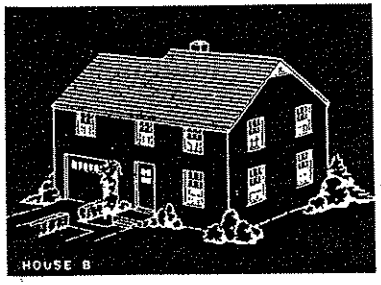
BUILT-IN GARAGES add to the livability of houses by increased convenience and ease of access to the automobile. For economy a bedroom may be planned over the garage area. The accompanying illustrations show the effect of placing the garage in front of, on a line with, and back of the front wall of the house proper. The location of the garage with respect to the house has an important bearing on exterior appearance as well as the plan of the second floor. The built-in or attached garage reduces the length and cost of the driveway and also saves one wall.

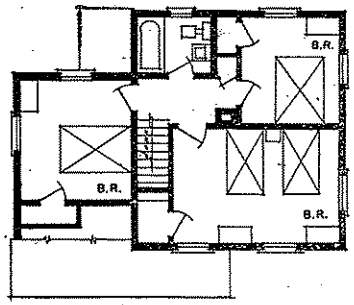


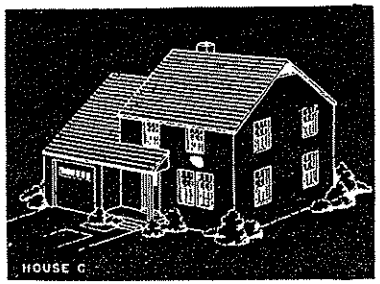
HOUSE B

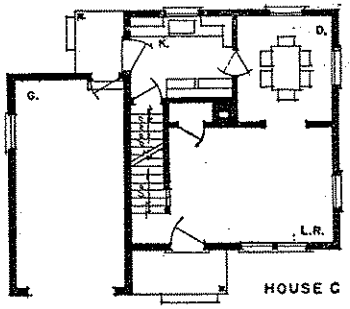


HOUSE B









HOUSE C

Continued from page 10

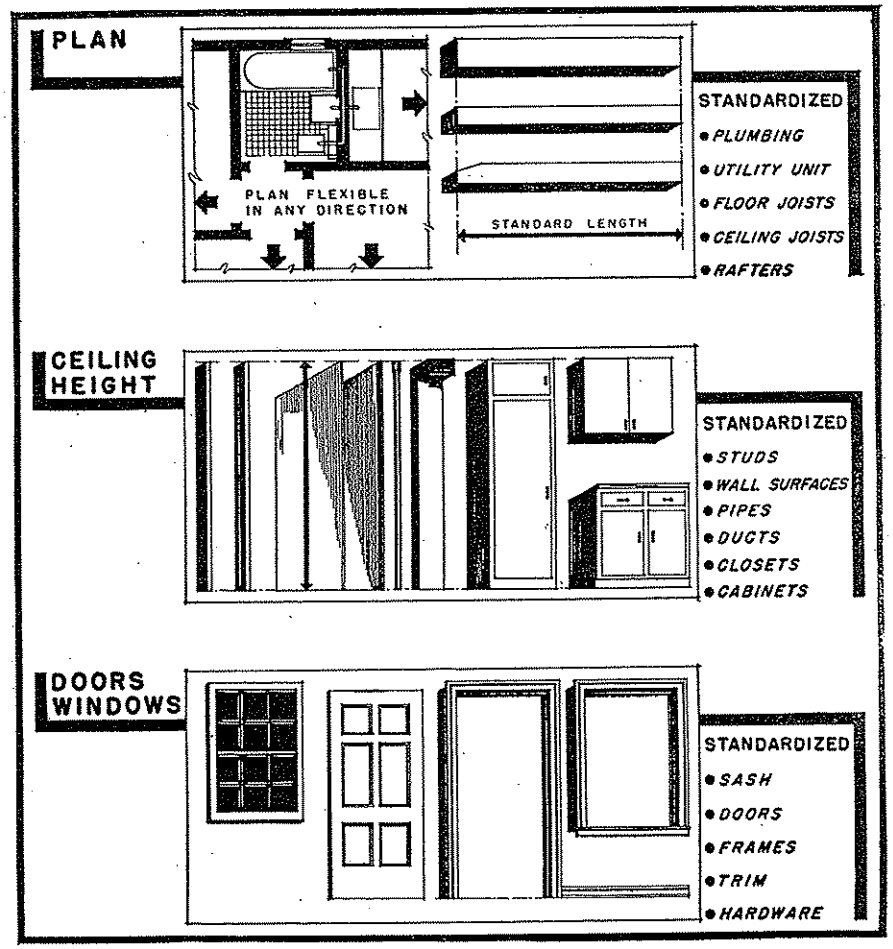
area required by the stairway. This stairway in an average house requires about 25 square feet of floor area. The ground area of a two-story house is not increased since the basement stairway can be planned under the stairway to the second story without increasing the area of the first story.

A first floor utility room of minimum area requires about 15 square feet more floor area than an inside basement stairway. The utility room increases the floor area of a house which has neither basement nor utility room nor a basement with outside cellar steps. A utility room does not necessarily increase the ground area of a two-story house, though this largely depends upon the plan and total number of rooms needed.

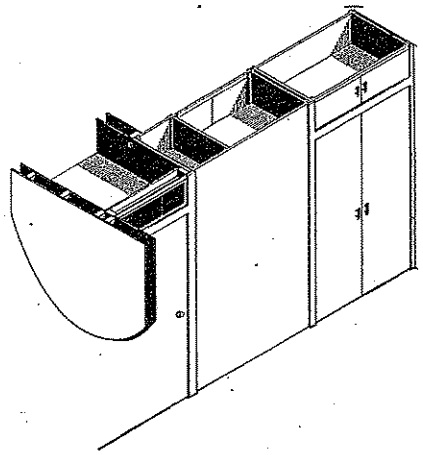
In southern locations where deep foundations are not required, a basement will probably add an appreciable amount to the construction cost due to the additional excavation and foundation walls required. In northern locations where deep foundations are required, because of deep frost penetration, the cost of building a basement is generally a negligible amount. In any location where the site has sufficient slope to require foundation walls approximately or more than that needed for a basement, a basement is generally economical. In locations where a basement adds an appreciable amount to construction cost, but the heating system required or desired must be placed below the first floor, a partial basement of sufficient size to accommodate the heating equipment, and space for laundering and for general storage, may prove to be the economical solution.

PLANNING FOR CONSTRUCTION ECONOMY

Construction economies depend primarily upon the shape of the house, use of stock materials, and simplicity with which the structural shell can be framed. The shape of the house is important, due to the amount of outside wall and roof area required to enclose a given amount of space. The square is the most economical shape since it provides the maximum amount of floor area with the least amount of wall area. Corner construction costs more than straight-wall construction with the result that square and rectangular shaped plans are less costly than L, U or Z shapes. The square or rectangular shape also simplifies the structural framing system of both floor and roof and thus effects economies.



STANDARDIZATION of the parts of a house offers economies in construction without loss in flexibility in planning. Based upon a common unit of measurement parts can be made interchangeable. This form of standardization simplifies manufacturing and production and ease of erection. Cutting of materials on the job is reduced and waste is eliminated. This kind of standardization has been used for some years. Further standardization of parts and mechanical equipment of houses can be utilized to obtain cost economies, especially for low-cost houses.

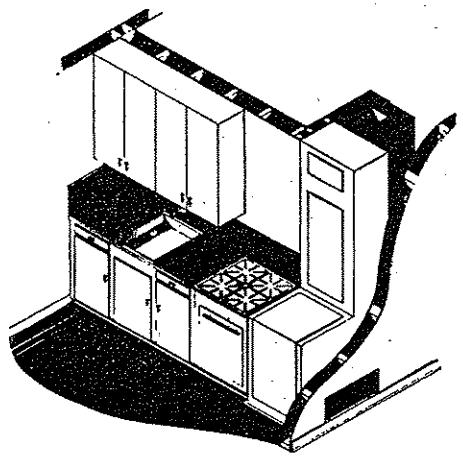


CLOSET UNITS fabricated in a shop and sent to the job ready to be set in place are a practical example of standardization of the parts of house construction. Standard closet units could easily form the partition between rooms. One adjustable unit would allow for reasonable variations in room sizes. The only standardization of houses required is that of ceiling height.

The size and arrangement of rooms in plan should permit the use of standard size floor and ceiling joists without waste of labor and materials. When this is done rooms of maximum size are provided by a given amount of labor and materials. The plan should permit the use of a simple structural framing system for floors, walls, and roofs. Spans from wall to wall or from walls to girders should permit the use of an economical joist size. Floor openings and intersecting roofs and dormers add to the cost of the structural frame by complicating the framing system.

Structural framing should be planned in relation to the mechanical equipment to permit the economical installation of pipes, ducts, wires and other items. Preplanning can avoid later additional framing or the adjusting and cutting of structural members. By considering the structural framing with the plan, it is often possible to reduce total wall heights with corresponding economies in the cost of framing, finishing materials, and possibly other items.

Stock millwork items such as door and window frames, doors and window sash, kitchen cabinets, finish trim for wall openings and cornices, and other items are an economy. Much of this equipment and many finishing items today are so well designed and manufactured that special items become a luxury. Stock moldings of good design are available in various sizes and shapes and can be readily combined to secure effects of wide variety.



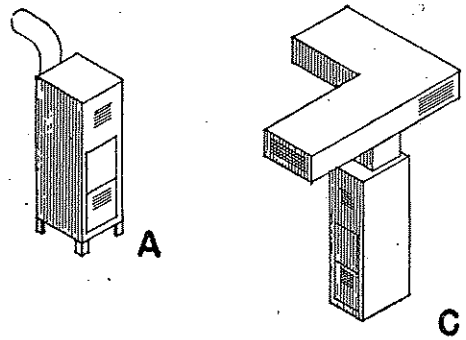
KITCHEN-BATHROOM partition can be a standardized unit which provides for the connection of kitchen and bathroom plumbing fixtures. This partition may be composed of standard kitchen cupboards, refrigerator, sink, and range. The sketch also shows a heating unit for a small house combined with the kitchen unit and built-in adjacent to the chimney.

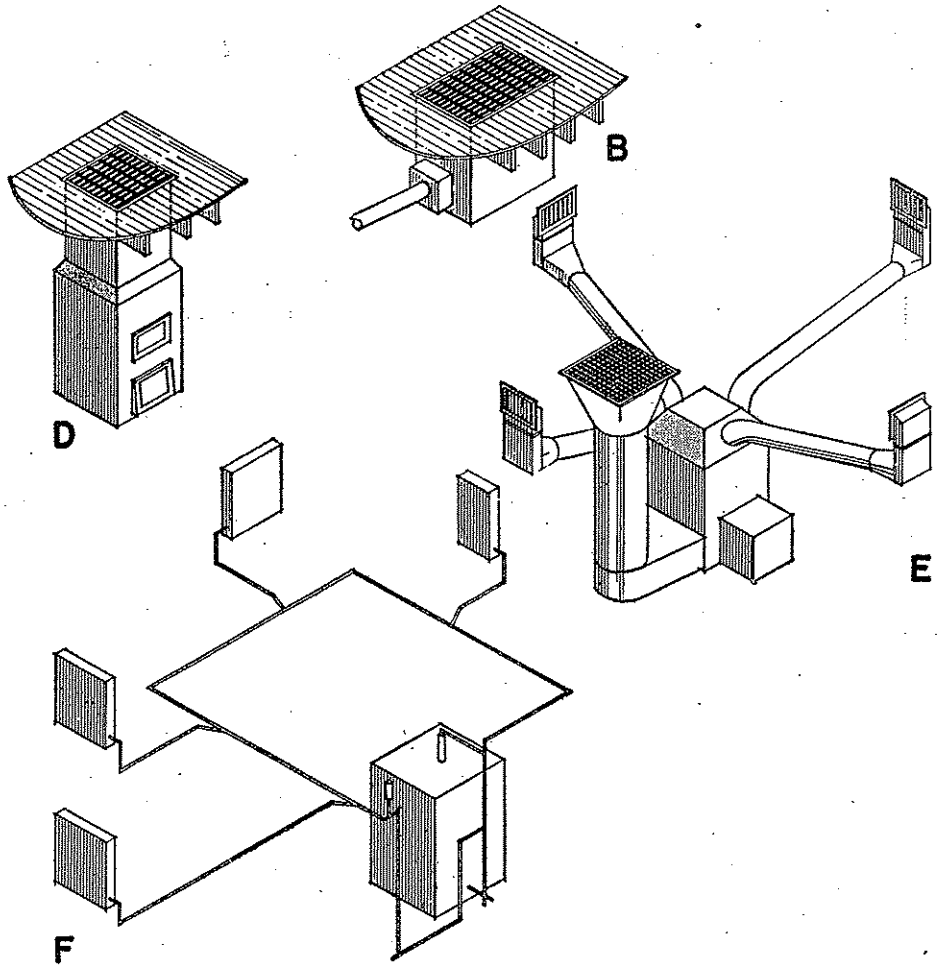
HEATING EQUIPMENT AND THE PLAN

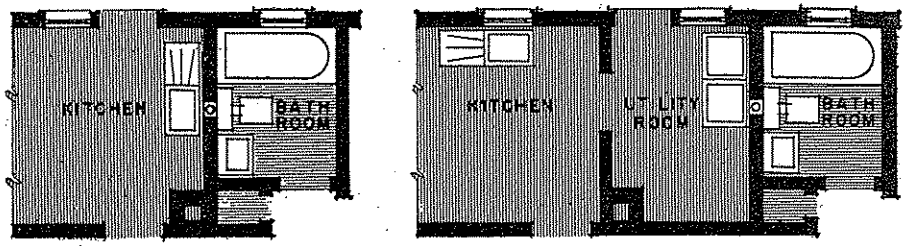
Room arrangement of the plan has an important bearing on the type of heating equipment selected, resulting comfort, and economical installation and operation of the equipment. A stove or circulating space heater is the simplest form of heating unit and the least costly to install. Uniform distribution of heat throughout the house, however, is uncertain, if not impossible, and must be recognized as a limitation which affects resulting comfort. When this type of heating equipment is used the plan should be compact and rooms so arranged that free circulation of air to all rooms is provided. The heating unit may be placed in the living room and may be fired with oil, gas, or coal.

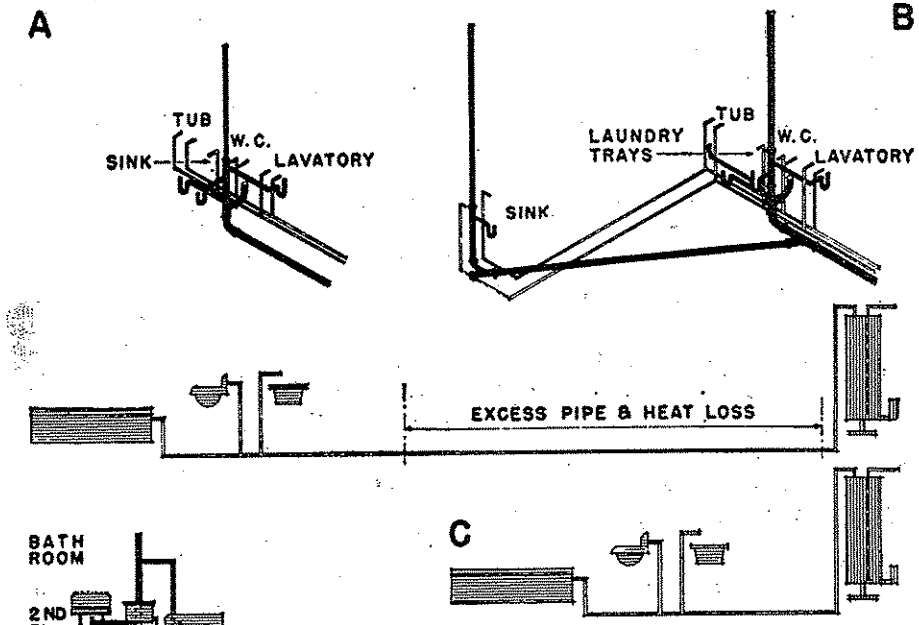
Another type of unit heater is known as a floor furnace. It may be fired with gas or oil. The unit is hung below the floor. Access to the floor furnace should be provided by means of a trap door or an opening in the foundation wall. Return air registers may be placed in individual rooms and connected by ducts to the heating unit to improve the circulation of warm air to each room. A supply of fresh air from out-of-doors is desirable and the unit must be connected to a chimney flue for proper venting. The warm air supply may be through a floor register located over the heating unit. Other arrangement for the warm air supply can be made by placing the unit under a partition so that air is supplied to two rooms by wall registers or the heater can be placed under a centrally located closet having a raised floor which permits the use of wall registers to supply heat to several rooms.

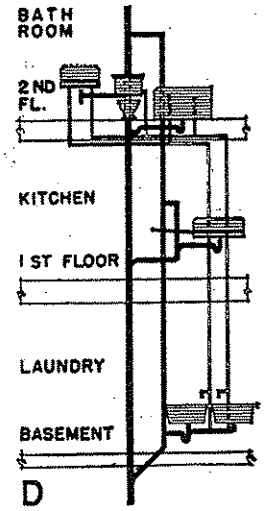
HEATING SYSTEMS for small houses may be grouped as those that may be used with or without a basement and those which require at least a partial basement. In the first group are: **A** Stove or circulating space heater; **B** Floor furnaces; and **C** Forced warm air with ceiling plenum. Forced hot water circulating system also may be used. The second group includes: **D** The pipeless furnace; **E** Gravity or forced warm air furnace with ducts to individual rooms; **F** Hot water or steam systems.











ECONOMY IN PLUMBING installations is obtained by locating plumbing fixtures to avoid an excessive amount of piping. **A** This objective can be obtained by planning the kitchen and bathroom back to back when both rooms are on the same floor. **B** If the house contains a utility room which includes laundry trays, this room should be located adjacent to the kitchen and the bathroom. **C** Location of the hot water storage tank and heater close to fixtures requiring hot water will result in economy of piping, quantity of water used, heat loss from piping, and fuel required to heat the water. **D** In two-story houses, basement laundry, kitchen, and bathroom should be placed approximately over each other.

A forced warm air, or forced hot water heating system may be used with the heating unit placed in a first floor utility room or small heater room. Where the plan is compact it is possible to connect the warm air supply to a plenum chamber formed by furring down the ceiling of a small hall and forcing, by means of a fan, warm air direct from the plenum through registers located near the ceiling of the individual rooms. When the plan does not permit this arrangement, individual air supply ducts will be required from the heater to the rooms to be heated.

Gravity warm air, hot water, and steam systems must be installed below the first floor. For economy in construction these may be placed in a partial basement with access from outside the house. For greater convenience it is desirable to have access to the heater space from inside the house when an inside stairway can be included. In either case warm air systems of the pipeless type, or gravity or forced air supply systems using ducts to individual rooms, may be used. When the heating equipment is placed below the first floor any type of steam or hot water heating system also may be used. Hot water and steam radiation systems and warm air systems using air supply ducts to each room have the advantage of providing for a more positive circulation of heat and more nearly uniform temperature control of individual rooms than is the case with other types of heating methods.

When a heater is used in any space which is not open to outside air sufficient ventilation must be provided to assure efficient fuel combustion. The use of an inside chimney especially for one-story houses results in more economical construction, better chimney draft, and better operating economy. The rating and capacity of most heating devices are based upon chimneys of definite size and height. For successful operation of this equipment it is essential to provide a chimney flue of the same proportions. This deserves especial attention in small houses to avoid the construction of chimneys with flues of insufficient area and height for correct draft conditions.

PLAN FOR MINIMUM PLUMBING COST

Plan arrangement has an important bearing on the cost of the plumbing installation. By concentration of plumbing lines the installation can be made with a minimum amount of labor and materials. In a one-story house this can be accomplished by an arrangement of the fixtures to permit wastes, vents, and water-supply lines to be placed in a partition between the kitchen and the bathroom. This requires the use of a minimum amount of pipe and but one soil stack. Where a utility room is used on the first floor, by proper grouping of rooms, concentration of the plumbing lines can be obtained with resulting economies. In two-story houses plumbing can be concentrated vertically by placing the second story bathroom over the kitchen and basement plumbing under the kitchen. In all cases installation and operating economies will result by placing the hot water storage tank and heater as near as possible to the plumbing fixtures which require hot water. Plumbing fixtures for economy should be selected on the basis of utility as to size, quality, and design.

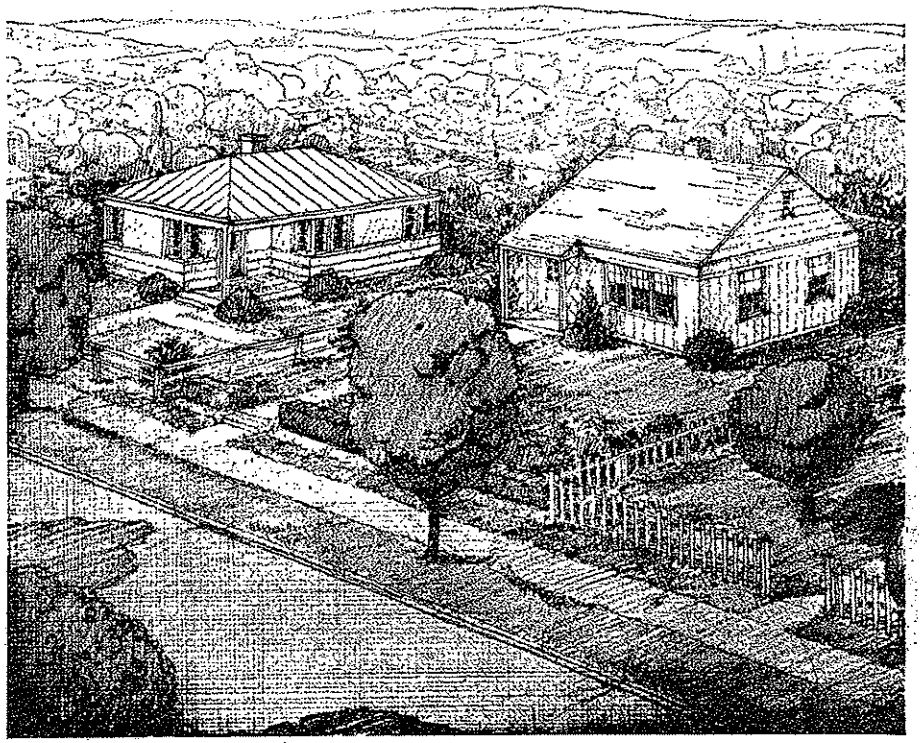
EXTERIOR DESIGN

The plan arrangement must not only provide the utmost in livability, but must also lend itself to a pleasing exterior. The design of the dwelling and its accessories should be attractively and effectively related to the size, shape and topography of the lot; be in harmonious accord with one another; afford a straightforward expression of residential character; present an inviting and home-like atmosphere; and be characterized by simplicity, harmony and refinement.

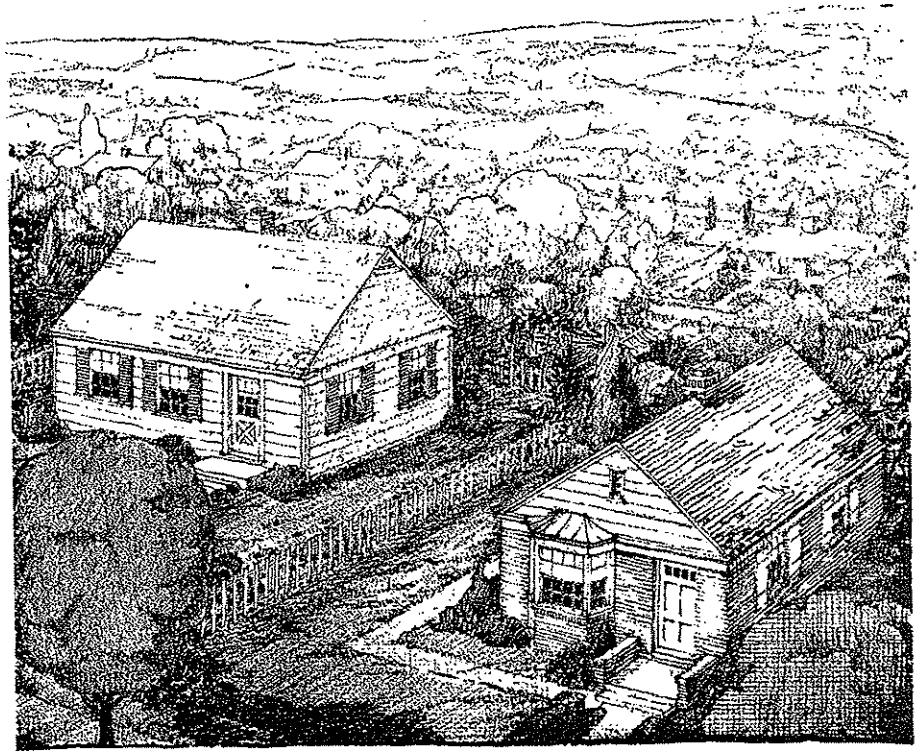
Simplicity in exterior design gives the small house the appearance of maximum size. Simplicity is gained by avoiding complications in the mass of the dwelling, by the use of unbroken roof and eaves lines, and by dependence upon a few well-chosen materials which harmonize in color and texture. The use of several different materials, especially those which contrast in color, breaks up the exterior into a series of small areas, making the house appear smaller than it really is. To obtain the effect of size, the small house should be treated as one large color area. If the house is faced with masonry or stucco, the facing should be continued down to the ground to overcome the distracting, and frequently unattractive appearance of the foundation walls. On houses faced with wood this can also be accomplished by painting the exposed foundations a matching or harmonizing color.

Harmony is exhibited when there is such accord between the various parts of the composition that the effect of unity is produced. Harmony is achieved by the restful arrangement of well-proportioned window and door openings in pleasing relationship to the wall spaces in which they occur. Exterior proportions are improved by minimizing the appearance of height in relation to the width and length of the house. This is aided by setting the house as low on the ground as possible.

Refinement, sometimes termed "good taste", is characterized by freedom from ostentation and by restraint in design. It is gained by eliminating features which tend toward over-ornamentation. Unnecessary gables and dormers, over-elaborate cornices and other nonessential items preclude the attainment of this desirable quality.



EXTERIOR APPEARANCE of houses of the same plan can be varied through care in the choice and use of materials. In the houses shown above and on the facing page variety has been obtained by turning the plan, and by varying the materials and combinations of materials. The house at the left might have a high base of wood siding with stucco above or the base could be of masonry or concrete units with stucco applied to masonry of concrete units above; the second house indicates the use of vertical boards and battens for the walls and horizontal siding in the gables; in the third house horizontal siding for the walls and flush boards in the gable ends might be used; and the fourth house suggests the possible use of brick for the walls and some type of siding or shingles in the gable ends. Porches, bay windows, and platform steps are useful as a means of making small houses more livable without adding greatly to their cost.



The simplest and least costly plan is a rectangle. Even a rectangular house can be given character and pleasing variation from its neighbors. Corner windows may often be used effectively when the exterior design is well studied. They aid in gaining increased wall space in small rooms and afford a broader outlook. Where windows of the usual type are used, they should not be placed too near the exterior corners because this makes the corners appear weak. The exterior appearance can frequently be given added interest by the use of a well-designed entrance doorway, by adding a well proportioned porch and by the judicious use of garden walls, fences and similar accessories. The added cost of an effectively placed bay window may be justified by the resulting improvement in the outward aspect of the house as well as in the added livability of the interior. Interest may also be gained by combining different forms of the same material. In the case of wood, flat boards, with or without moulded edges, applied horizontally, in combination with vertical boards and battens, ordinary clapboards or shingles, are frequently very effective. Brick and stone may be

combined, or used with wood for interest in texture, particularly when painted a single color to obtain a harmonious whole that will first appear to the eye as a single unit.

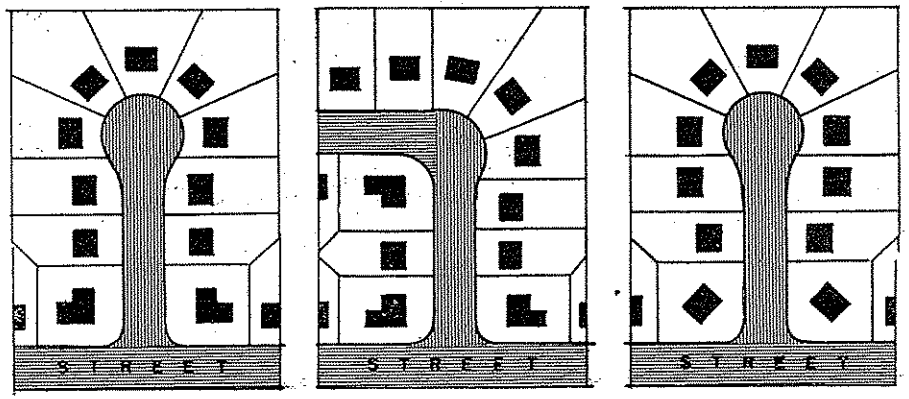
Unless the building budget will permit construction of an outside chimney of good proportion in relation to the size of the house, it is highly desirable and more economical to use an inside chimney. Outside chimneys built to the minimum size are usually too tall and narrow for good exterior appearance. When built against gable ends they have the effect of bisecting the composition, thus destroying its unity and the appearance of width.

If a garage is desired and the site size permits, it may be attached to a small house, or placed close at hand and connected to the house with a covered passage which also serves as a service porch. Either makes the house appear larger. Both provide greater convenience than when the garage is located some distance away. The maximum of convenience is provided by the built-in garage, particularly when the site topography affords ease of entrance for the car without need for a steep driveway, as when the garage is located in the basement of a hillside house. Despite their added convenience, attached and built-in garages sometimes blank out house walls in which windows might otherwise be placed, precluding cross ventilation. For this reason the nearby detached garage, connected to the house by a covered porch or passage, or the attached garage which overlaps only a small portion of the house, is usually preferred.

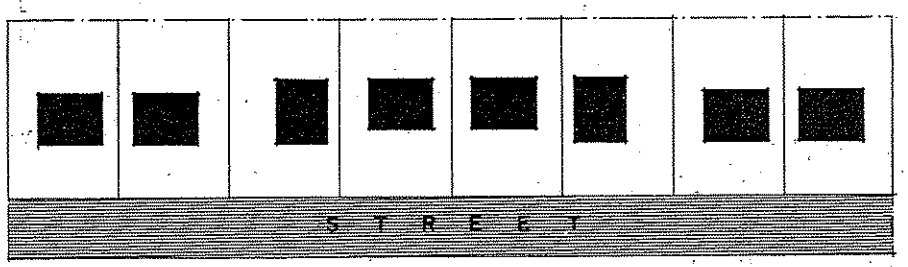
LOT PLANNING AND IMPROVEMENT

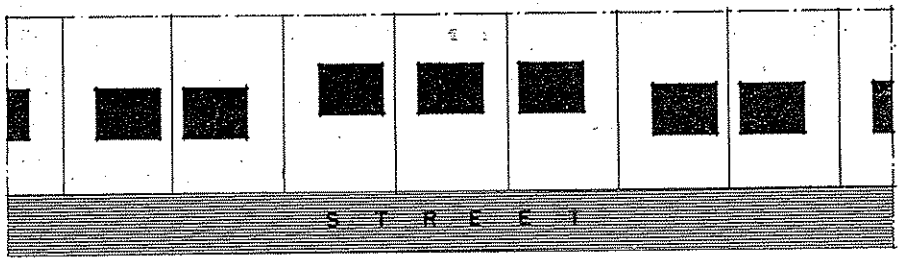
The livability of the home is enhanced by its proper location on a lot of adequate size and proportions. The lot area should be sufficient to provide ample space around the dwelling so that all rooms may have natural light and a plentiful supply of fresh air. The garage and service facilities should be conveniently placed. The garden areas should be arranged to permit ample open space for outdoor living. All of the lot improvements should present a unified composition which is attractive, particularly when viewed from within the dwelling. By planning the lot arrangement in advance, the improvements may be developed in the order of their need and importance, as the owner's budget permits.

The arrangement of lot improvements and the first floor plan of the dwelling should be studied together, as a single unit, in order that the development of outdoor and indoor space may be so coordinated that all conditions are advantageous to the comfort, convenience, and safety of the occupants. In planning the house and locating it on the plot, advantage should be taken of unusual topography so as to produce a unified composition, both as to plan arrangement and

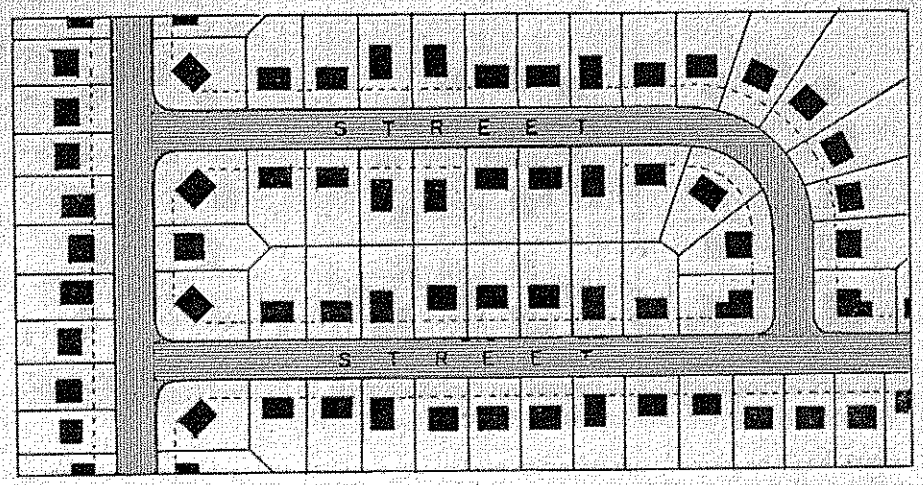


Houses should be located, with respect to neighboring dwellings and to those across the street, so that an interesting picture is presented and the effect of monotony is precluded. The location of houses on interior lots should be normal to street and lot lines.

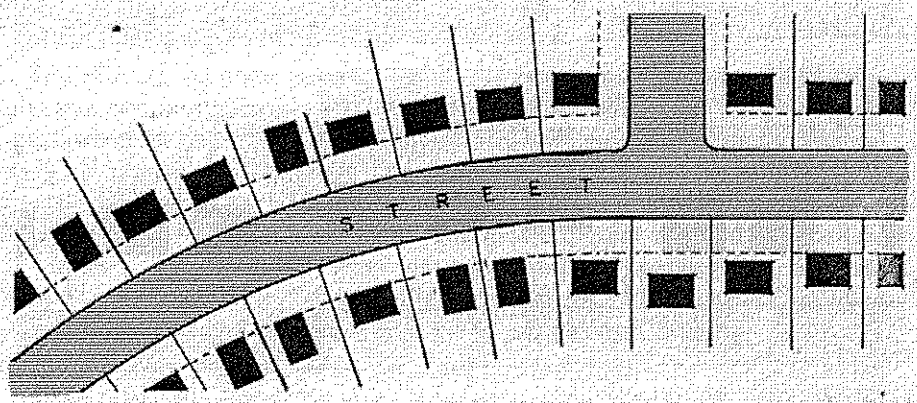




Variations in grouping of houses to further avoid monotony can be obtained by varying the widths of side yards. Where all houses on the street are located in the center of each lot, there is a monotonous regularity in spacing even though the exteriors are varied in design. Variations in the widths of side yards should be so arranged that an appearance of openness results through the increased space between groups of dwellings. Setback and side-yard variations should be considered in relation to the design of individual houses.



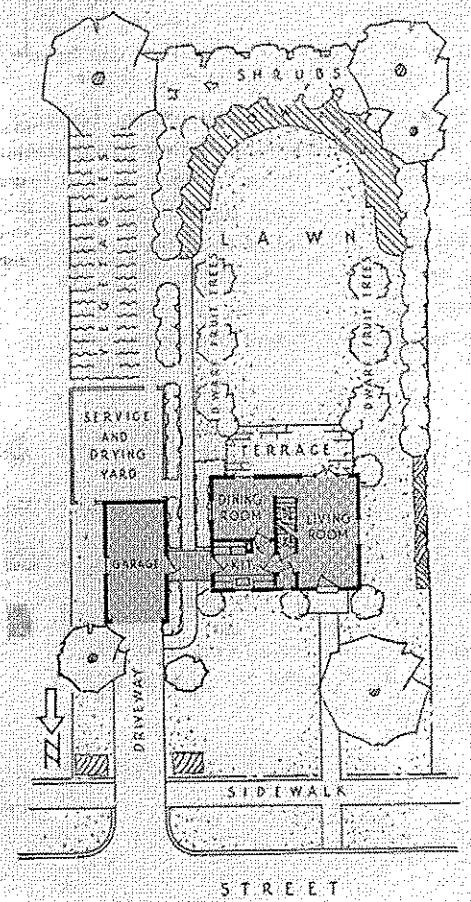
When houses are lined up like soldiers along both sides of a straight street a monotonous appearance results. An interesting effect may be created and monotony avoided by setting some of the houses farther than others from the street line. This requires study, as haphazard arrangements usually result in a confused appearance. A restful and unified picture is presented when groups of dwellings are set back to give the effect of open courts. An unattractive vista of rear yards down the center of the block should be screened by one or more dwellings placed on lots which are interposed between the corner lots at the end of the block.



When streets are decidedly curved, monotony resulting from locating houses equidistant from the street line is generally overcome due to the changing vista of houses built to a curving setback line. However, slight variations in setback of house groups may also be desirable.

as to exterior appearance. The setting provided for the dwelling by its surroundings should enhance its design. When viewed together they should afford a restful, attractive and harmonious picture.

The physical improvements on the lot should be so arranged and installed as to provide convenient access to the dwelling and accessory buildings for both vehicles and pedestrians, to provide positive drainage of the lot and the diversion of water away from buildings and its disposal from the site, and to provide an attractive setting for the dwelling. The dwelling should not be placed so close to one side or to the front or rear of the lot, or so far below or so high above the street level that it is not presented to best advantage. Smoothly graded slopes rather than steep terracing or sharp embankments and the use of appro-

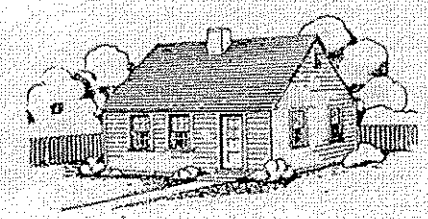


INDIVIDUAL LOTS for low-cost properties can be simply planned for economy, livability, and convenience. The lot plan illustrated suggests one possibility in planning for the ultimate development of the lot and coordinating this with the dwelling arrangement. The plan indicates the separation of outdoor living and service areas, the use of a few shade and fruit trees, vegetable garden, and inexpensive shrubbery arranged in areas for greatest effectiveness. The placing of the garage near the front building line and its connection to the house add to the convenience of the occupants and increases the amount of usable rear yard area.

priate planting properly arranged will accentuate the best features of the dwelling and the site.

Planting is a particularly useful adjunct to the design of the small house. Trees and shrubbery add to the livability and when correctly placed, enhance the architectural character of the house. Shade trees should be located so that they will provide shade from the hot afternoon sun and also frame the dwelling design. Use of trees to interrupt long and unbroken roof lines usually unifies the composition and augments the desirability of the property. Screen planting or shade trees are useful in subduing the large doorway of a projecting garage, which might otherwise appear unduly prominent. Trees need room to grow and should not be planted too close to the house. Fruit trees are sometimes desirable for their blossoms as well as for their fruit.

In selecting material to be planted close to the house, slow-growing compact evergreen and deciduous varieties should be chosen, of types that are easily maintained and will not develop quickly and hide the house from view. It is usually desirable to place the higher growing specimens near the corners, banking them with appropriate low shrubs. A row of even-height planting completely surrounding a house results in an unpleasant appearance. The use of a few specimen plants at the dwelling entrance and other accent points, and of additional well located groups of shrubs is much more effective than the haphazard placement of isolated plants. Hedges are frequently desirable along the lot lines, as they increase privacy and prevent paths from being worn in the lawn. The complete ensemble of house and setting should present a pleasing and unified composition.



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