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Organization of individual aided self-help housing projects

IN PUERTO RICO

ideas and methods exchange no. 55

HOUSING and HOME FINANCE AGENCY
Office of the Administrator
International Housing Service
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FOREWORD

Aided self-help is a technique by which the unused leisure time of people in all parts of the world can be utilized in work, singly or in groups, to build homes for themselves--through their own efforts, with aid from the community or other sources.

This aid may take the form of loans for land and building materials, technical guidance, and group organization. It is with the latter--group organization--that this publication deals.

Observation has indicated that some aided self-help housing projects have failed largely because the work was not well organized. As a result the projects dragged and the participants became discouraged.

It is important, therefore, that this phase of a project not be ignored or left to chance. It is hoped that the experience gained in Puerto Rico will be helpful to others.

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ORGANIZATION OF INDIVIDUAL AIDED SELF-HELP HOUSING PROJECTS IN PUERTO RICO

INTRODUCTION

The success of any aided self-help housing program is contingent on many factors, most of which have been discussed in Ideas and Methods Exchange No. 18, Aided Self-Help in Housing Improvement. These include analyzing the needs and resources of the country and establishing a sound policy; selecting the communities; selecting the groups of participants within the communities; designing houses to meet the needs of the participants; selecting materials and construction methods which can be readily handled by the participants with a minimum of supervision; organizing the groups for maximum efficiency; scheduling use of materials to minimize delays and waste; and encouraging wholehearted participation.

All of these factors have been considered in the Puerto Rican aided self-help program. Organization of individual projects and scheduling material so that the time of the group is used effectively and the work progresses smoothly and rapidly are the factors to be discussed here.

The success of the rural and, more recently, the urban aided self-help projects in Puerto Rico stems greatly from the fact that projects are carefully planned, all work and materials are scheduled in advance, nothing is left to chance, and the enthusiasm of the participants is maintained throughout.

Success is evidenced by the fact that the Rural Program, supervised by the Social Programs Administration which has been in operation since 1949, is currently producing about 1200 houses a year, and that more than 4500 houses have been built since the program's inception.

The Urban Program, also under the Social Programs Administration, has been functioning on an organized basis only since 1958. The first group of 35 houses completed under this program was built on lots provided by the Puerto Rico Housing Authority.

Organization of both projects was geared to production of very simple reinforced concrete houses. This type of construction was adopted for several reasons: first, cement, sand and gravel are readily available; second, reinforced concrete will withstand the force of hurricanes to which the island is subject; third, it produces a house that requires little maintenance, is not subject to decay or deterioration, and does not harbor vermin; fourth, poured concrete is a material that is readily handled by unskilled people with a minimum of training and supervision; fifth, when well-built, standardized, re-usable forms are employed, the pro-rated cost per house of the forms is very small; and sixth, the labor of the participants goes directly into erection of the houses without preliminary preparation of building materials, i.e., making blocks.

The Puerto Rican houses are standardized. The rural houses (Figure 1) contain 324 square feet and consist of a living-dining room, kitchen and two bedrooms. The urban houses (Figure 2) contain 600 square feet and include a living-dining room, kitchen, three bedrooms and a bathroom.

It is obvious that neither the design of the house nor the organization and work pattern developed in Puerto Rico can be transplanted elsewhere without modification to allow for differences in type of construction, availability of materials, capabilities and temperament of the people, and the time participants can devote to work. Nevertheless, the experience in Puerto Rico should be helpful even in countries where conditions differ greatly.

Pattern of Project Organization

Organization of a rural project (and presumably a similar pattern will be followed with an urban project) begins with an exploratory meeting held in a selected community to acquaint the people with the program. Following this meeting a list of interested people is prepared and these steps are taken:

1. Final selection and orientation of participants.
2. Organizing work groups and establishing working hours.
3. Scheduling the work.
4. Procuring and scheduling materials and equipment.
5. Encouraging wholehearted participation.

Selection and Orientation of Participants

At least three orientation meetings are held in Puerto Rico for prospective aided self-help groups at which the program and the responsibilities of individual members

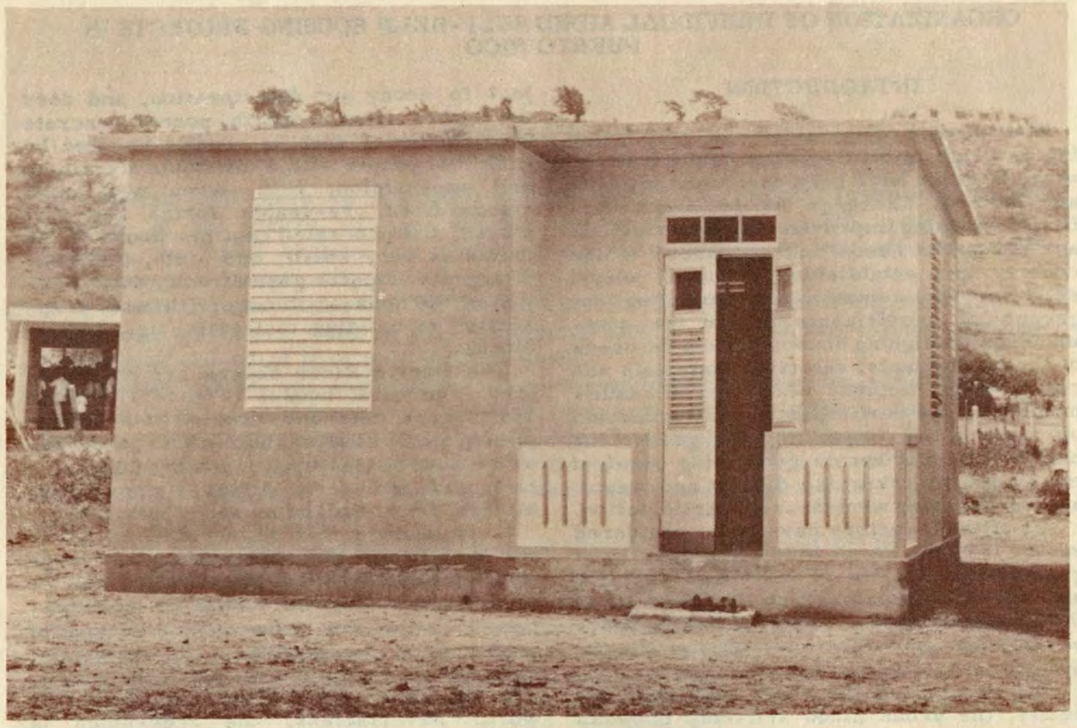

Figure 1. 18' x 18' rural house.

are thoroughly explained. Attendance is mandatory for all participants. At the first meeting a Mutual Savings Society is organized through which members can save the necessary $20 down payment and $2.50 accident insurance premium. During the course of these meetings those who are not prepared to save the down payment or who are not able to devote the required amount of time to construction of the houses or who for other reasons do not wish to participate, drop out. The meetings also afford an opportunity to identify those who can be looked to for leadership as well as to spot potential troublemakers.

The Social Programs Administration believes that groups should be composed of at least 30 members and that groups as large as 50 can be successfully supervised by one foreman. Before a group can start to work, at least 30 members must have made the necessary down payment. As a result the group keeps a check on members who are not saving regularly.

By the time these meetings are over, every participant knows exactly what is expected of him and what he will receive as a result of his labor.

Establishing Working Hours

At the organization meeting, the group decides on hours of work. The schedule is tailored to the needs of the group, but once established each individual is expected to contribute an equal amount of time to the project insofar as he is physically able.

The next step is to prepare a schedule of working hours with each participant signing up to work certain days. Some adjustments are usually necessary so at least a minimum group is on hand each day.

Each working group is assigned a task to finish each day. Slackers who have to work eleven hours to complete a job that should take only 9 hours, work faster next time.

Rural Program. While schedules may vary with different groups, in general each individual works a minimum of one 8-hour day during the week and one 8-hour day over the

Figure 2. 20' x 30' urban house.

weekend. In addition 10 "extra hours" are usually required. These may be worked evenings (2 hours each evening during the week) or on weekends or a combination of evenings and weekends.

In order to work effectively, it is necessary that there be at least 6 men on duty at all times when concrete for foundation walls and floors is being poured and at least 7 men when roof slabs are poured. Usually more are on the job.

A week's work schedule for a group of 30 men pouring floors or walls might be established as follows:

	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		
	D[1/]	E[2/]	D	E	D	E	D	E	D	E	D	E	D	E	TOTAL
Men	6	30	6	30	6	30	6	30	6	30	15	-	15	-	30
Man hrs.	48	60	48	60	48	60	48	60	48	60	120	-	120	-	780

1/Day 2/Evening

A week's work schedule for the same group pouring the roof might look like this:

	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		
	D	E	D	E	D	E	D	E	D	E	D	E	D	E	TOTAL
Men	7	30	7	30	7	30	7	30	7	30	15	-	10	-	30
Man hrs.	56	60	56	60	56	60	56	60	56	60	120	-	80	-	780

Urban Program. The work schedule for the first urban program of 35 houses undertaken by the Social Program Administration at the "San Jose" Project was somewhat different. Here the group agreed that each man would work one 9-hour day (7:00 a.m. to 5:00 p.m. with one hour for lunch) during the week and one 9-hour day on either Saturday or Sunday. The decision to work on the project one day during the week was made possible by the fact that the employers of the participants agreed to excuse them from their regular work. In the case of the urban house at least 6 men are needed to pour footings; 7 to pour foundations, floor slabs, and the first course of the walls; 8 men for the second course of walls; and 9 men for the last wall course and roof slab.

A typical week's work schedule for a group of 35 men pouring foundations walls:

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	TOTAL
Men	7	7	7	7	7	20	15	35
Man hrs.	63	63	63	63	63	180	135	630

Procuring and Scheduling Materials and Equipment

Puerto Rico is fortunate in one aspect of its self-help projects. Most of the materials used in construction of the houses, such as cement, sand and gravel, are readily available within a reasonable distance of each project. Consequently it has been unnecessary to order such items in advance, or to stockpile them.

As a rule, materials are ordered by the supervisor each week, and are promptly delivered to each site.

One item purchased in advance is steel since it is cut to length in a central shop and bundled according to the number, length, and size of rods required for each part of each house. The steel is stockpiled at the central warehouse and delivered to the site of each participant's house on receipt of a warehouse order.

Pipe, 3/4" diameter or less, (for the urban project) was cut and threaded on the job. Even a week's supply of materials requires some storage. In addition, equipment and small tools need some protection.

On the rural projects, materials and equipment are delivered to and stored at each individual site. The participant who lives at the site is responsible for properly protecting and guarding them. On the urban project, a 40 x 60 foot area was fenced with barbed wire for the storage of larger equipment such as wheelbarrows, concrete mixers, and forms that are not in use. A 12 x 20 foot shed was built of used lumber and sheet iron but this was found inadequate. Two of the houses were rushed to completion and used to store items such as cement, windows, and small tools under lock and key. A latrine was also built at the urban project.

A bulletin board was erected to keep detailed records of:

1. Daily hours worked by each man and by his relatives, friends, or substitutes.
2. Sacks of cement used daily.
3. Steel bars drawn from stock.
4. Progress of work.
5. Daily inventory of equipment.

Equipment Used

The equipment used on the 30 to 35 unit projects included one set of foundation wall forms, one set of wall forms, four sets of roof slab forms, and one $3\frac{1}{2}$ cu. ft. concrete mixer plus small tools such as wheelbarrows, shovels, picks, hammers, saws, etc.

Puerto Rico has been trying three different types of forms. The type first developed for the Rural Program consists of a set of foundation forms 30 inches high and a set of inside and outside forms 39 inches high for walls above grade to be poured in three 36 inch steps. (Figure 3) This requires moving both the inside and outside forms up twice.

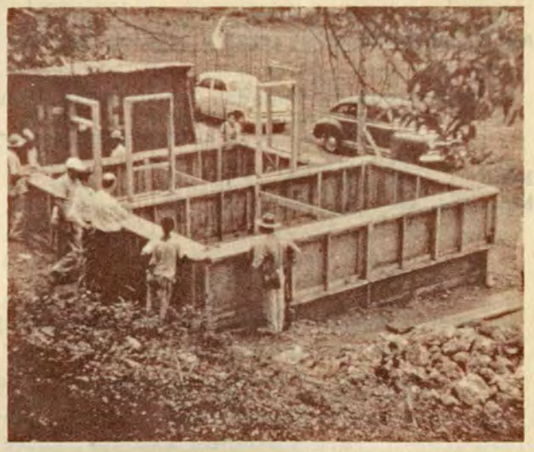

Figure 3. 39" high wall forms.

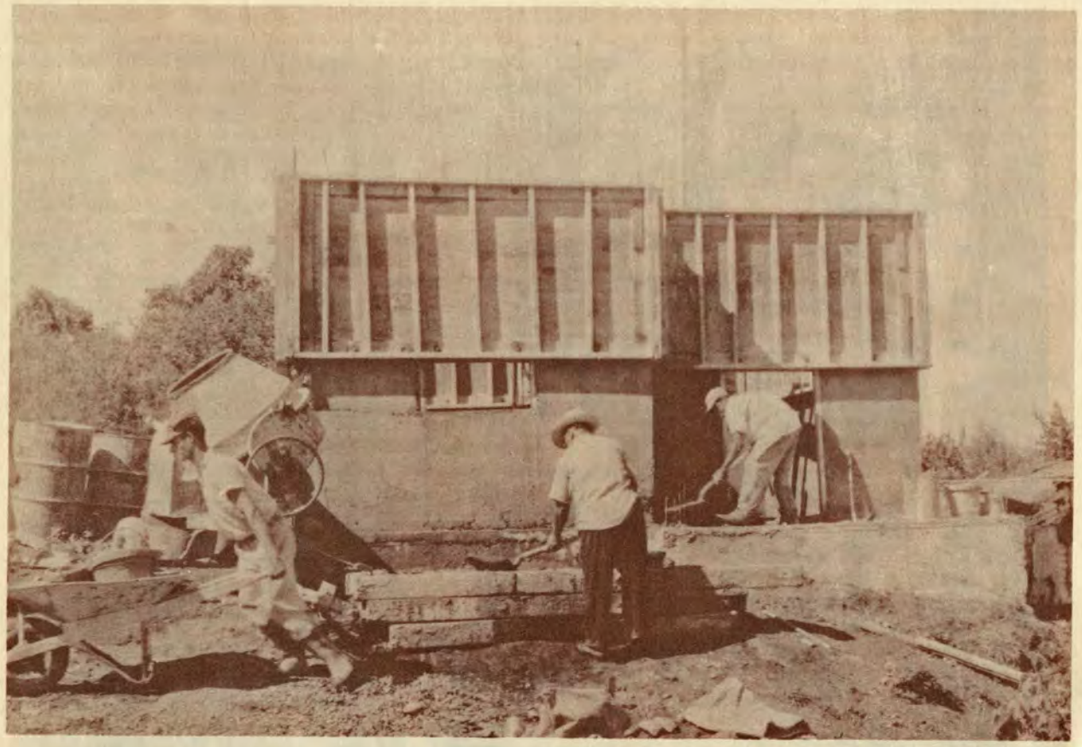

Figure 4. 54" high wall forms.

The second type, used in the Rural Program, consists of a foundation form and a set of forms 54 inches high so that the wall above grade is poured in two steps. (Figure 4) This requires moving the forms only once.

The third type, used in the Urban Program, consists of an inside form the full height of the wall (9 feet) and an exterior form 39 inches high. This involves moving only the outside form twice.

In addition, a fourth type might be used: one in which the inside form is full wall height and the outside form is 4' 6" high, thus requiring only one move.

The forms used so far consist of a wooden frame with exterior-type waterproof plywood facing. These forms for the 18 x 18 rural house cost about $2,000 and can be used for about 100 houses. More recently a set of steel and plywood forms have been purchased from the Universal Form Clamp Company at a cost of about $10,000 (Figure 5). These should be more durable and easier to assemble and take apart.

Construction of Houses

Since the procedure involved in the construction of the urban house is somewhat more clear cut than in the rural program, it will be used as the example of the pattern followed in Puerto Rico.

The houses in this project are 20 x 30 feet in size with three bedrooms, a living room, kitchen, and bath (Figure 6). The following is a brief outline description of the structure.

Footings	6" x 15" reinforced concrete
Foundation walls	5" reinforced concrete
Floors	3" unreinforced concrete
Walls	4" reinforced concrete
Roof (Flat)	3" to 5" thick, reinforced concrete, sloped to drain
Interior partitions	4" concrete blocks
Windows	Aluminum jalousies

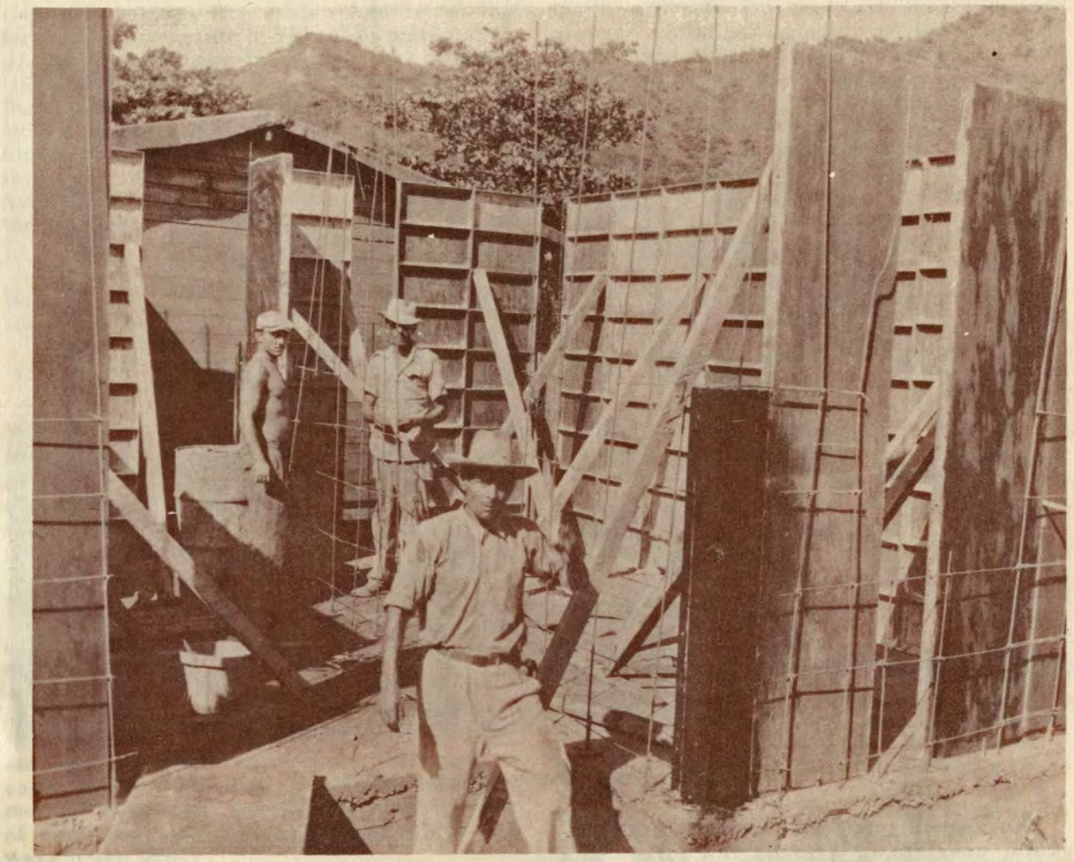

Figure 5. Steel and plywood wall forms.

Doors	Flush panel, mahogany plywood
Plumbing	2" to 4" cast iron and $1\frac{1}{2}$" to 2" galvanized pipe (fixtures and wiring supplied by families)
Electricity	Electrical conduit (fixtures and wiring supplied by family)

Foundations. Trenches were dug to a depth of 24 inches. The steel reinforcing was placed and the footing was poured in the earth trench. The foundation forms (30 inches high) were set on the footing and concrete poured to a point 6 inches above the sidewalk, or the highest ground.[3] The concrete for both footings and foundation walls was poured directly from wheelbarrows.

Of about 500 cubic yards of excavation for the project, the first 100 yards were excavated using the full labor force. From then on, concrete was poured every day and excavation was relegated to Saturdays and Sundays and any week day when there were enough men on the job to do it simultaneously with concrete pouring.

The pouring time for footings and foundation walls, floors and the roof slabs is given in Table I.

[3] This was a level site.

TABLE I

Time Required to Pour Concrete for Footings, Foundations, Floor and Roof Slabs for 20 x 30 foot Urban House

Part of building	Footing	Foundation wall	Floor slab	Walls 1st course	Walls 2nd course	Walls 3rd course	Roof slab
Pouring by wheelbarrow or buckets	W[a]	W	W	W	B[b]	B	W
Cu. Ft. of concrete	71	130	137	118	89	99	253
Pouring time, hours	2	4	4	4	$2\frac{1}{2}$	3	7
Number of men	6	7	7	7	8	9	9
Cu. Ft. per hour	$35\frac{1}{2}$	33	34	29	35	33	36
Cu. Ft. per hour per man at floor level	6	5[c]	5				
Cu. Ft. per hour per man at 4 ft. level				4			
Cu Ft. per hour per man at 7 ft. level					4		
Cu. Ft. per hour per man at roof level						$3\frac{1}{2}$	4

[a] Wheelbarrow [b] Bucket [c] Approximate

Floor Slab. The three-inch unreinforced concrete floor slab is poured over tamped earth. Seven men can pour and finish two 20 x 30 slabs a day. Average pouring time is given in Table I.

Exterior Walls. Full height interior forms and 39-inch high outside forms were used for these houses. The inner form and the outer form for the lower third of the wall were set up, reinforcing placed, and concrete poured to a height of 36 inches (to under side of window openings) in 2 days with an average crew of 7 men. Whenever possible, concrete was poured directly from wheelbarrows into forms by hoisting and tipping the wheelbarrows.

The next day outer forms were stripped, frames for the jalousies and doors nailed to inner forms, outer forms were raised, and the concrete poured in 9 hours with a crew of 8 men. The concrete was emptied from the mixer into a wheelbarrow and then passed in buckets to men on a portable scaffold who poured it into the forms.

The following day, the outer forms were again raised,[4] this time to full wall height and concrete poured from the inside by men standing on a scaffold supported on the inner wall form. The concrete was emptied from the mixer into a wheelbarrow then into buckets which were passed from hand to hand to the top. The vertical reinforcing rods which were spaced 12 inches on center in the wall were allowed to project a foot above the top of the wall and were bent alternately in and out to anchor the roof slab. The final operation required about 9 hours with a crew of 9 men.

Interior Partitions. The interior partitions of the houses were built of 4-inch thick concrete blocks.[5] The door frames were set after the partitions were built up to the door head. Then concrete was poured between the frames and the partition to anchor them in place. A small reinforced concrete lintel was placed over the door.

Roof Slab. Four sets of roof slab forms were used for 35 houses. At least 2 and sometimes 3 days were required to erect a set of forms, place and tie steel, and place the plumbing vents and the conduit for electric wiring.

A 16-foot 2 x 4 was laid lengthwise on the center line of the slab as a guide for the screed so that the slab tapered from 5 inches thick at the center to 3 inches thick at the eaves. A 13 degree ramp, serving two houses, was set up so that wheel barrows could be pushed up with the help of a man with a towing hook. The concrete was then dumped directly from the wheelbarrows onto the slab. Concrete was screeded, sprinkled with dry rich mortar, and given a float finish.

The forms remain in place for at least 5 days and the slab kept moist to assure satisfactory curing.

A minimum of 9 men is required to pour and finish the roof slab containing 253 cubic feet of concrete in 7 hours.

Windows and Doors. All window openings were fitted with aluminum jalousies held in place with aluminum screws which engage coils made of #16 galvanized wire, made on the job, and embedded in the concrete.

Exterior doors were installed and varnished. (Interior doors were also provided but not installed by the group). All doors were mahogany plywood, flush panel doors. Frames were shop fabricated on good quality pine.

Plastering. Plastering was done by skilled masons (not participants) employed on a piece-work basis. Participants worked as helpers thus reducing the cost of the work.

After the last house was plastered, participants drew lots for houses and the remaining work was done by individual families on their own houses.

Plumbing, Wiring, Finishing. Plumbing lines in the houses were roughed in during construction. Participants connected water and sewer lines to mains, which were brought one foot inside the lot line, and installed their own toilet, lavatory, shower head and sink. They also were responsible for their own wiring and installation of fixtures which had to be done by a licensed electrician.

Paint in colors chosen by each family was issued and participants did their own painting; also finished the floors, and installed interior doors.

Encouraging Participation

The Puerto Rican aided self-help projects are highly organized and each participant is expected to work as hard and be on the job as regularly as he would for his regular employer. He is also expected to perform the tasks assigned by the foreman and to accept supervision.

In other words the projects are organized as nearly like a professional contract job as possible.

Competition among groups, working different shifts, was encouraged by posting the time required for each to complete similar jobs.

Participants were constantly urged to keep absences to a minimum so that every man would contribute an equal number of hours to the job. Every absence had to be accounted for.

The monthly totals of hours worked by each person were posted on the bulletin board along with a separate list of defaulters showing the number of hours to be made up.

Regular shifts had to be worked by the individuals in the group, but make-up time and, in the case of the rural projects, the "extra hours" could be worked by a substitute. In the Urban Program, the substitute was often a skilled worker such as a carpenter or mason who was employed and paid by the Social Programs Administration. The cost was charged against the defaulter.

Efforts were made to keep good working relations and a cooperative spirit within the groups.

This organization proves effective. The work progresses rapidly and smoothly and the dwellings are finished within a reasonable length of time. This is important. If a project drags, participants lose interest. It is estimated that 18 months is about as long as the enthusiasm of a group can be maintained simply because people get tired of devoting all of their spare time to work.

In the case of the Puerto Rican Rural Program, projects are completed within 6 to 12 months with an average time of about 8 months. The urban project of 35 houses was completed in 10 months with an average of 1,144 hours per man.

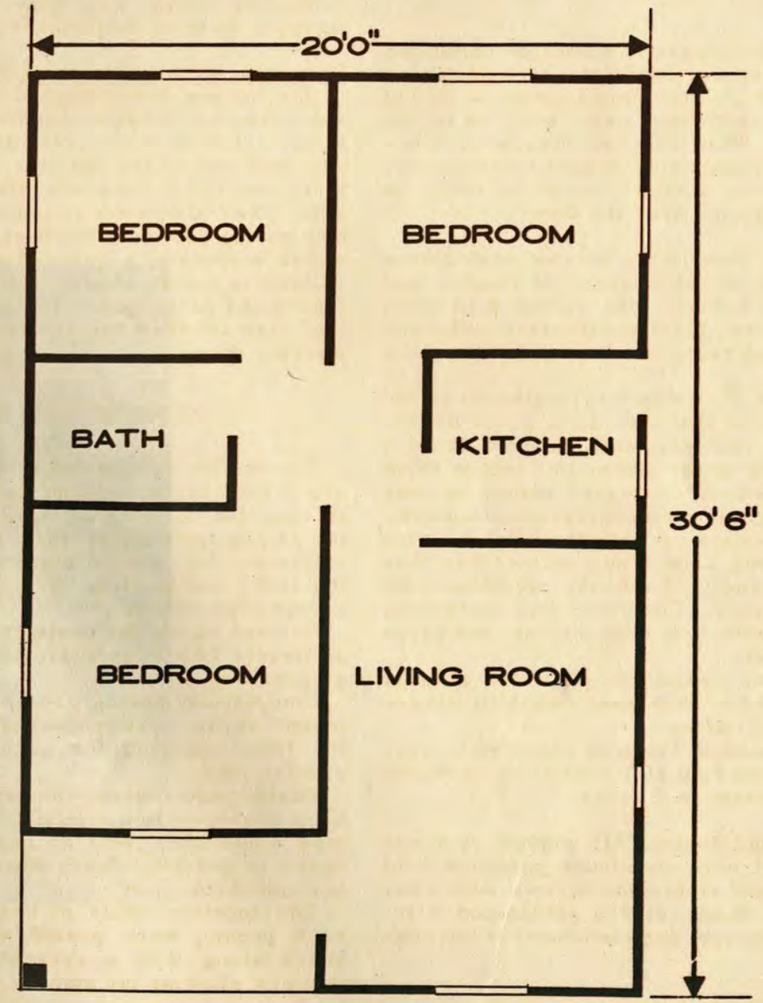

Figure 6. Floor Plan of Urban House.

[4] Wall forms are moved as quickly as possible after concrete has its "initial set" so that the surface may be rubbed down with burlap to a smooth finish. This makes plastering unnecessary.

[5] Poured concrete partitions are used in the rural houses.

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