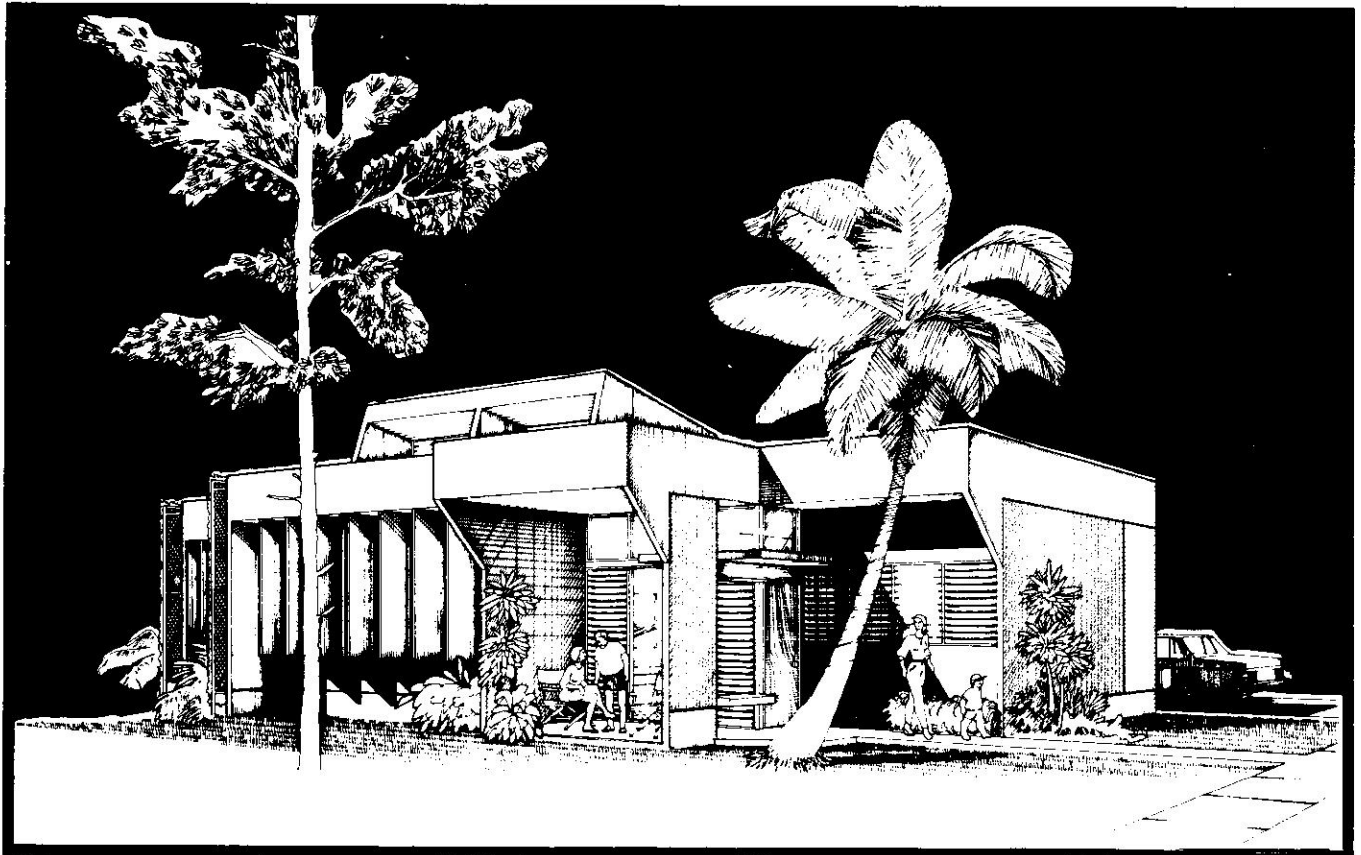




Low Energy Home Designs for Puerto Rico



Designs by Horacio Díaz, FAIA and Eduardo Díaz, AIA

DISCLAIMER

The designs, drawings, and specifications offered in this plan book are suitable for construction within Puerto Rico. Changes necessary to adapt the designs to other areas or to specific conditions of the chosen site should be performed by professionals competent in passive solar applications. In addition, the working drawings and specifications available through this plan book should be submitted for review to local building officials to assure compliance with code requirements. This should be done prior to site selection, financial commitments, or construction permit applications.

Neither the Commonwealth of Puerto Rico, nor any agency thereof, nor any of its employees, nor the Southern Solar Energy Center makes any warranty, express or implied, or assures any legal liability or responsibility for any third party's use or the results of such use of any information, apparatus, assembly, product, or functional efficiency exhibited within this plan book or represents that its use by such third party would not infringe upon privately owned designs or rights.

Library of Congress Cataloging in Publication Data

Díaz, Horacio.

Low energy home designs for Puerto Rico.

I. Architecture, Domestic--Puerto Rico--Designs and plans. G. Architecture and energy conservation--Puerto Rico--Designs and plans. I. Díaz, Eduardo. II. University of Puerto Rico (System). Center for Energy and Environment Research. III. Title.

DATE 1984

BY

83-2661

Introduction

Puerto Rico is fortunate to have one of the most consistently comfortable climates in the world. High summer temperatures average about 88°F in September, the hottest month, and winter lows in February, the coldest month, are typically around 68°F. This is indeed fortunate since high energy prices make mechanical air conditioning a costly option.

The houses in this book demonstrate how conscientious design can create comfortable houses without the use of mechanical cooling. They borrow some good ideas from traditional island architecture, such as light colored materials, window-shading overhangs, and heavy concrete walls, and update them with special modern features like the "parasol" roof shading system, special ventilation features, and solar water heating. A description of the thermal design features of each house design is included with the individual plan. Wherever possible, landscaping is used to provide shade, and the houses are oriented to take advantage of prevailing breezes. The result is pleasant, practical, low-energy homes.

All the house plans in this book have been reproduced at a standard scale of one-eighth inch to the foot. This gives the builder the option of working at this scale or producing full-size working drawings. Each house plan includes elevations, floor plan, and sections.

High energy costs in Puerto Rico make even modest investments in low-energy building features quickly pay for themselves. This is true not only of the house itself but also of water heating. Electric water heating is expensive, while the abundance of clear, sunny days makes solar water heating a practical alternative. Thus, solar water heaters have been incorporated in the low energy house designs to further reduce energy consumption.

Plan A

**Two-story, 1,706 square feet
3 bedrooms, 2 1/2 baths
Attached or Detached**

This two-story home is well suited for urban sites where lot sizes are small. The building contains 1,706 square feet of living space, including three bedrooms and two and one-half baths. It is oriented to catch the eastern trade winds to cool the house by means of cross ventilation.

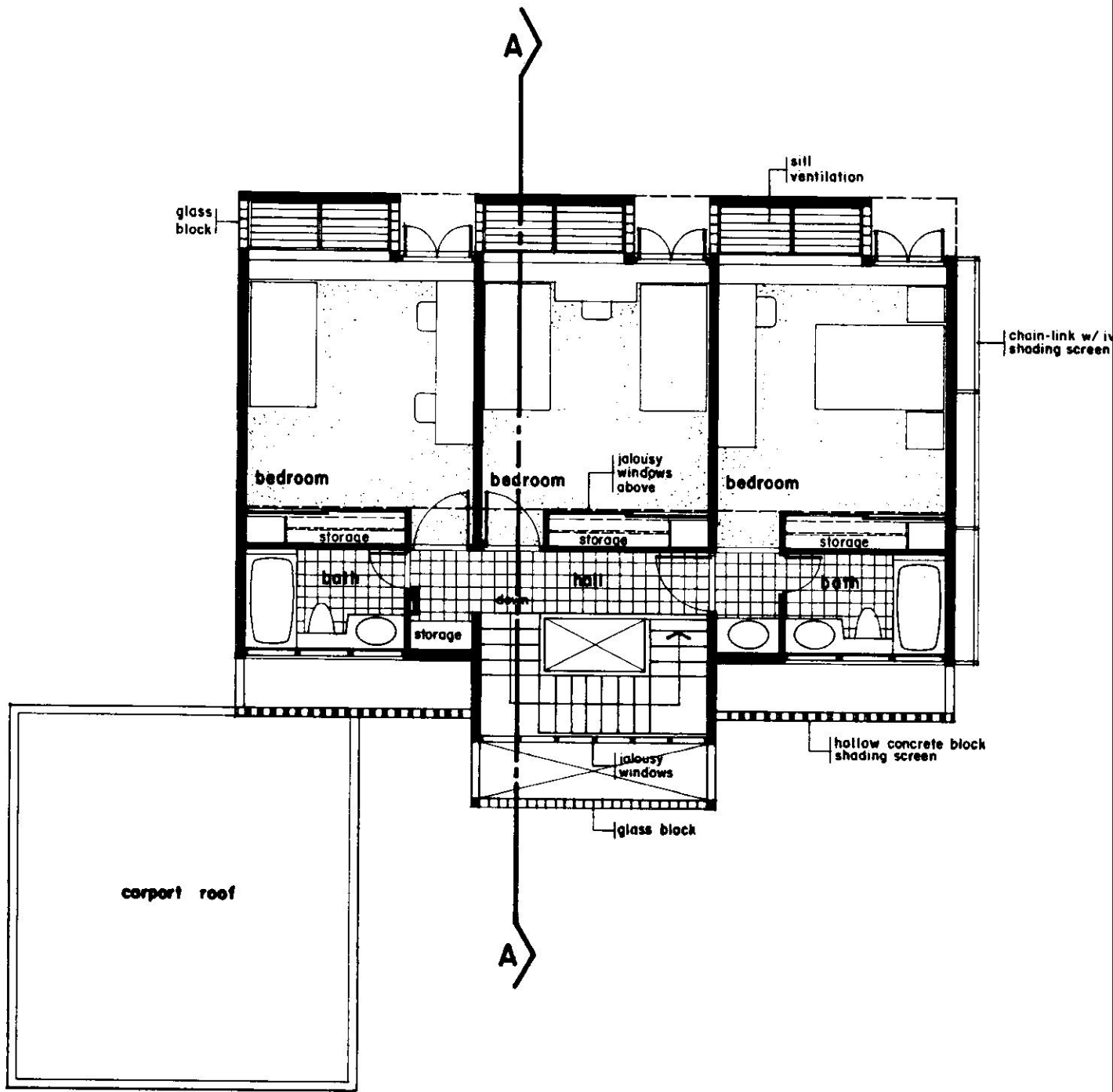
Solid walls on the north and south sides are suitable for a duplex or row-house arrangement. Living areas on the ground floor open to a partially paved, tree-shaded patio. An open stairwell with a whole-house fan above further enhances ventilation. At the second floor level, the bedrooms are cross ventilated through a combination of sill jalousie windows, louvered casement windows, and clerestory jalousie windows at the roof level. Further cooling is achieved through the use of exterior shading devices.

The concrete roof slab is shaded with a "parasol," a light metal secondary roof system. The south and west sides are also shaded, the south by means of an ivy-covered shading screen and the west through the use of hollow concrete block grilles. The glass block in front of the stairwell allows for light and privacy at the same time. All exterior walls and the roof are insulated with 1-inch rigid polyurethane insulation.

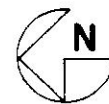
Individual window air conditioning units may be installed over windows and doors at transom level. A 50-gallon breadbox solar water heater has also been incorporated into the design and is located above the stairwell. Rainwater from the roof may be stored in a long water-storage tank over the east side's second-floor windows and used for flushing toilets, bathing, and watering plants.

Landscaping has been carefully planned for this small lot. In the patio, two medium-sized trees of sparse foliage provide shade but allow the breeze to filter in. On the southwest side, a large tree provides some additional protection from the afternoon sun. Ground cover is grass. Exterior finishes on the house range from exposed concrete on the north and south sides to light-colored cement plaster on the east and west.

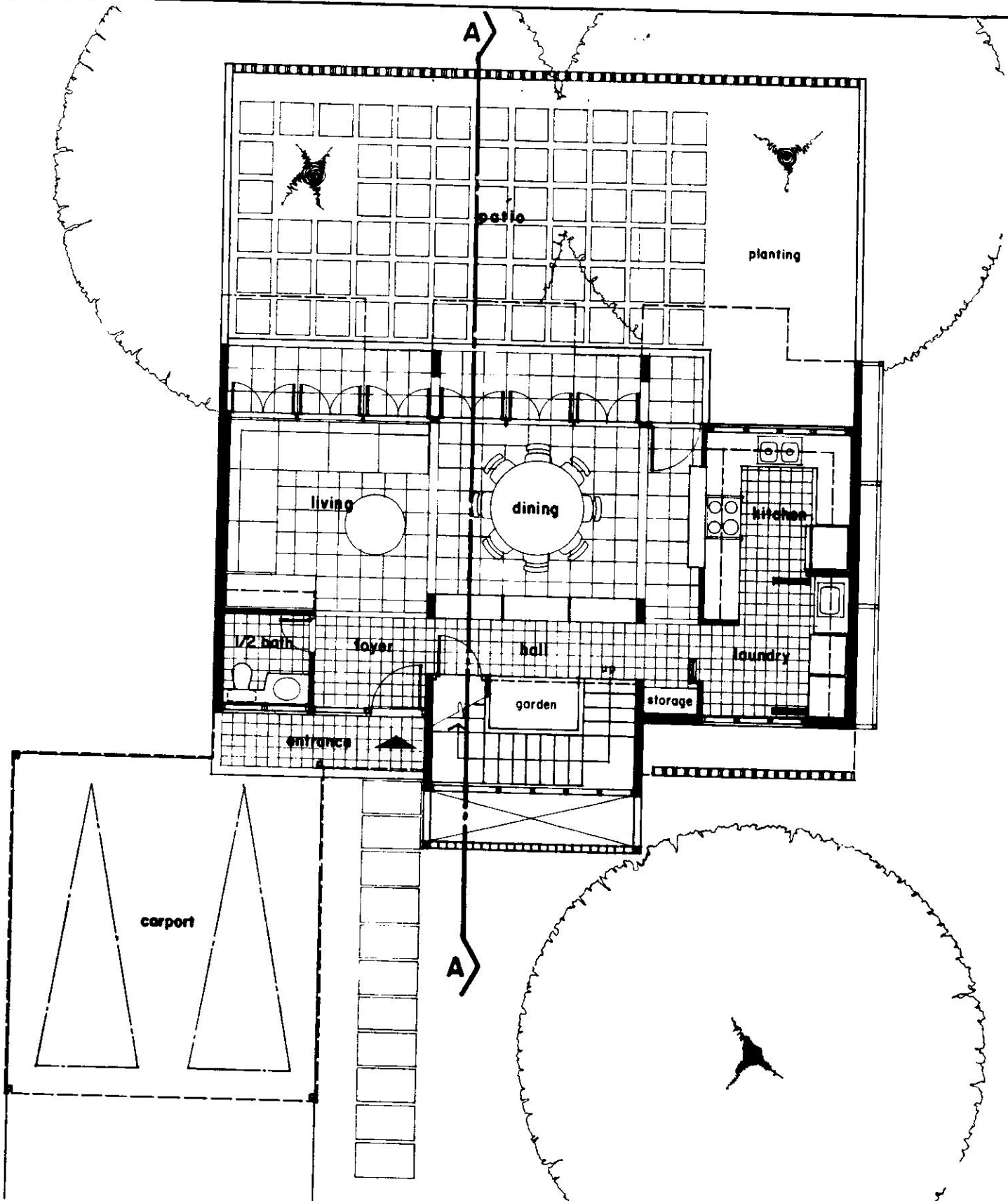
PLAN A



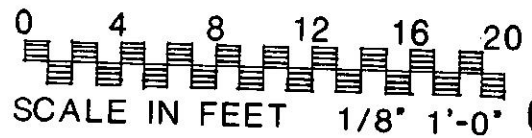
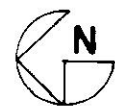
SECOND FLOOR PLAN



Plan A: Three Bedrooms, Two and One Half Baths
 Low Energy Home Designs for Puerto Rico

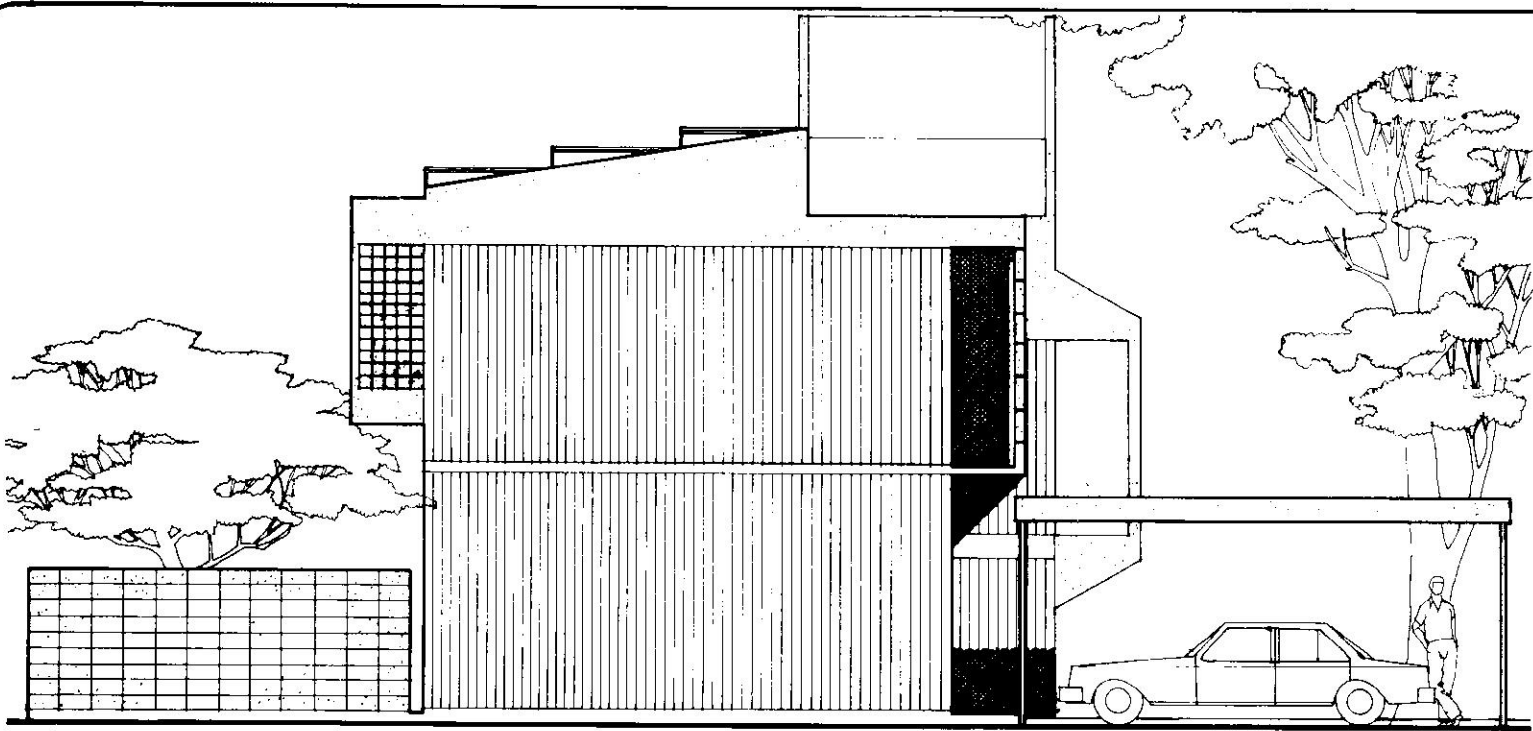


FIRST FLOOR PLAN

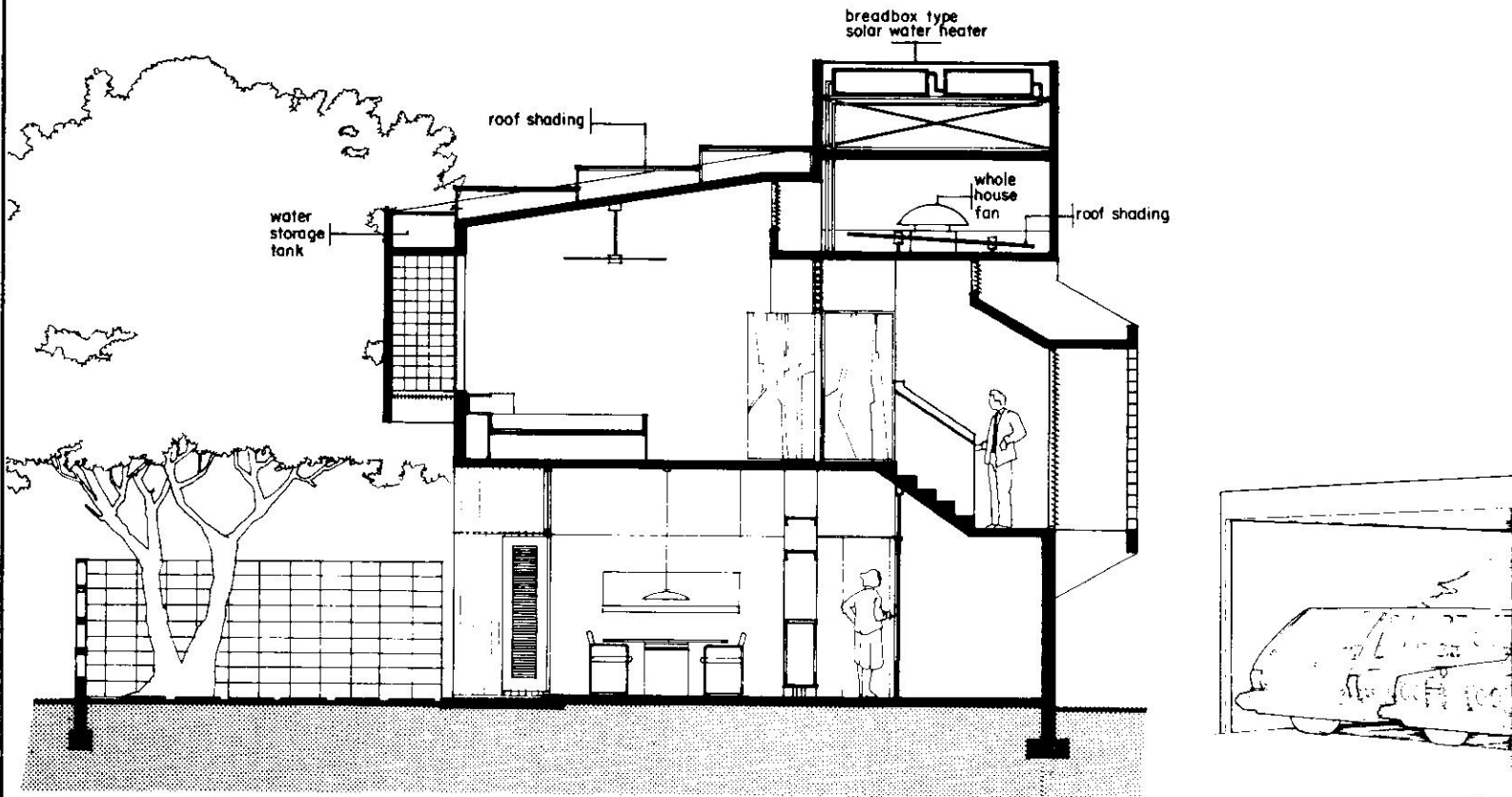


SCALE IN FEET 1/8" = 1'-0"

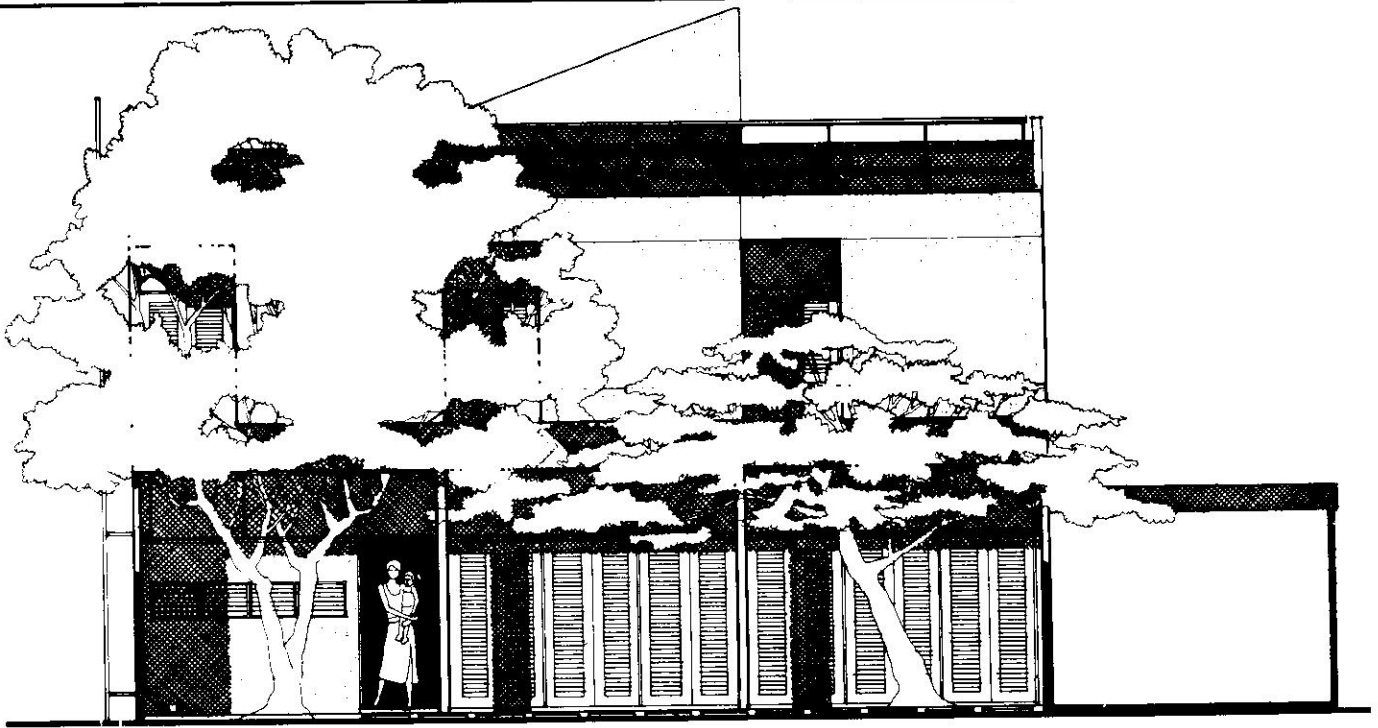
PLAN A (CONT.)



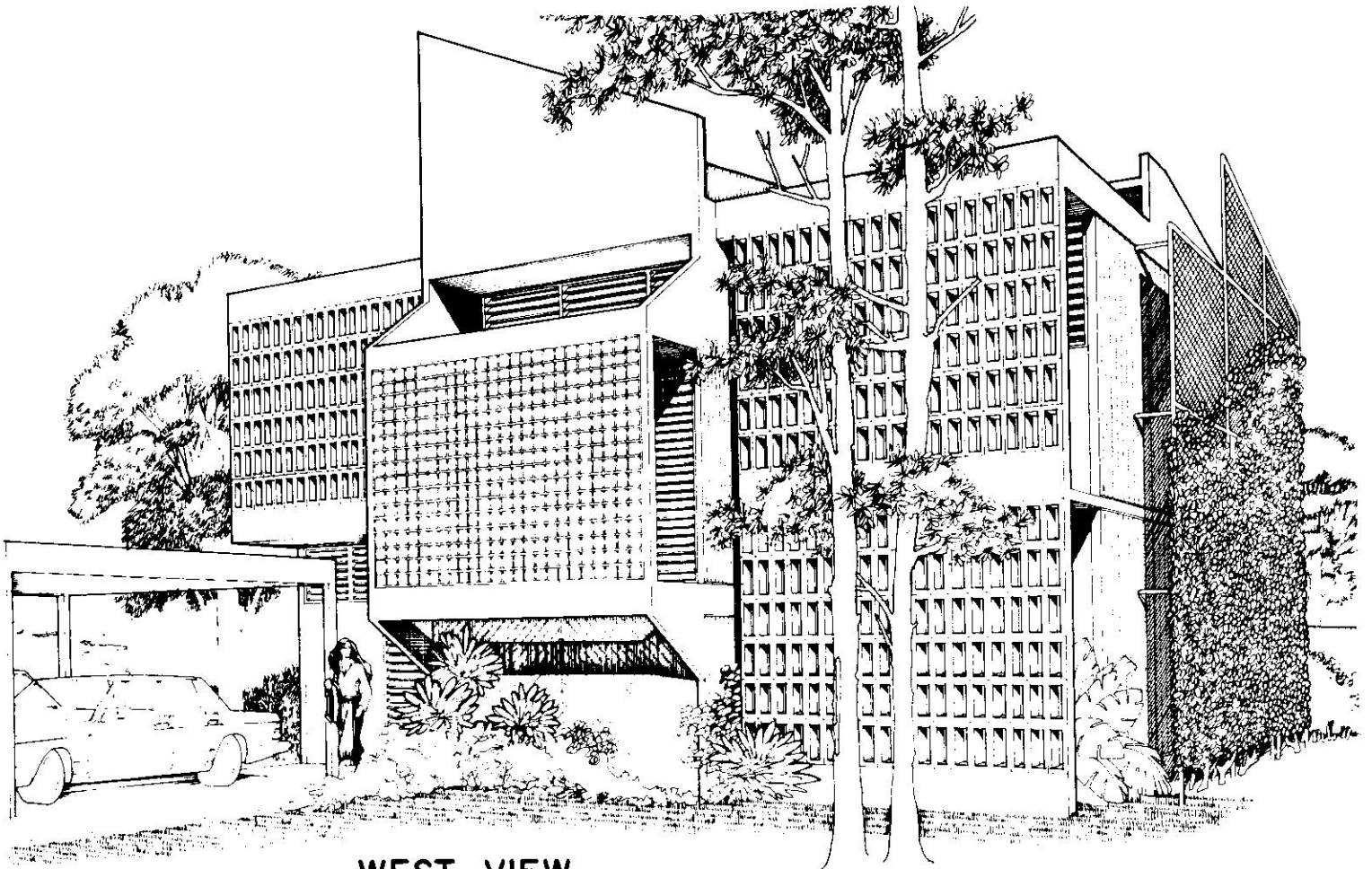
NORTH ELEVATION 0 1 3 7 15 FEET



SECTION A-A 0 1 3 7 15 FEET



EAST ELEVATION 0 1 3 7 15 FEET



WEST VIEW

Plan A

Plan B

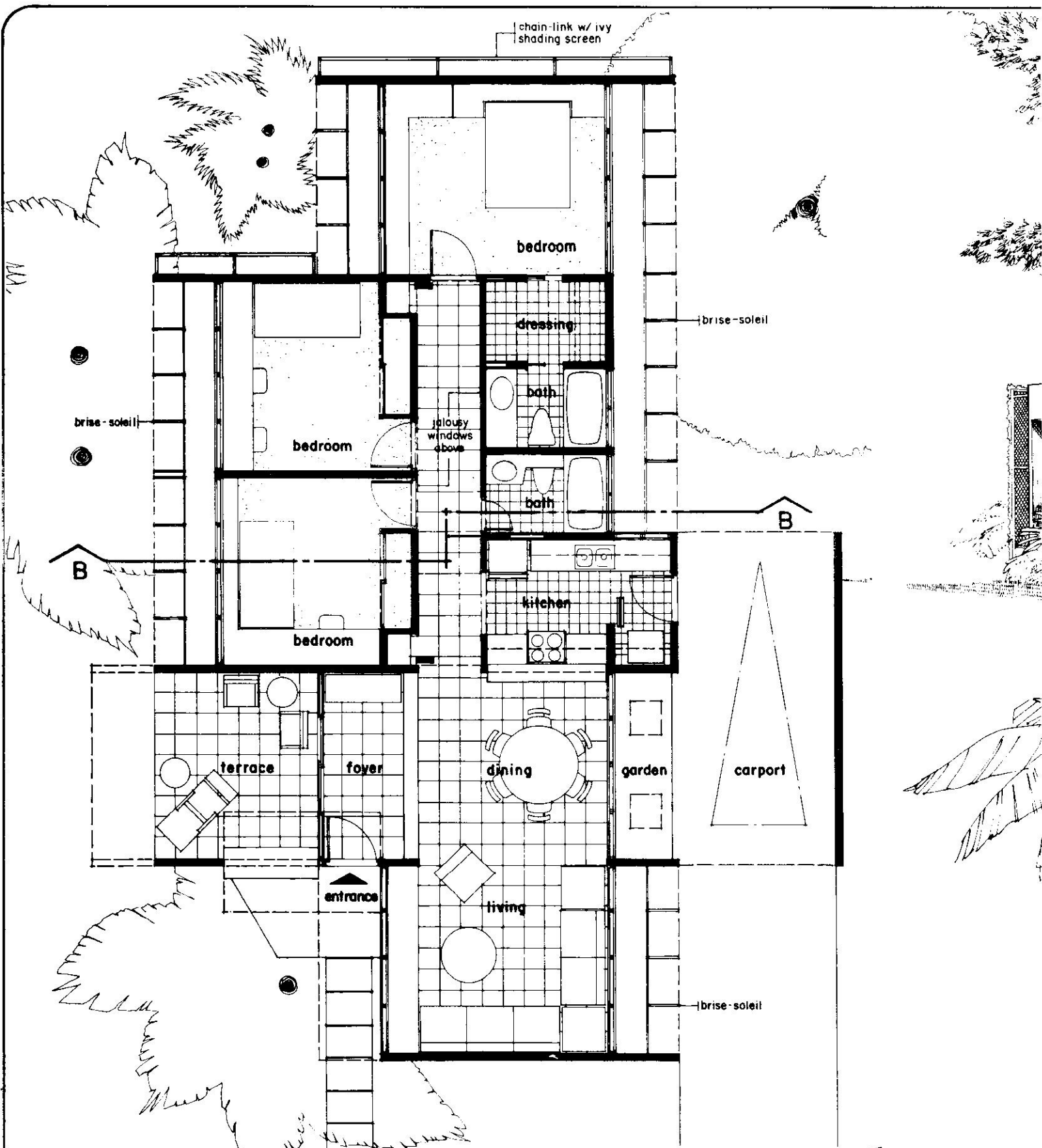
**One story, 1444 square feet
3 bedrooms, 2 baths
Detached**

This house has been designed to compete with the most widely built and accepted type of housing in the Puerto Rican market today--the suburban development home. Its living space of 1,444 square feet includes three bedrooms and two baths. The long axis of the house runs north to south to catch the easterly trade winds. Wooden jalousie windows are generously used along the east and west sides of the house. In combination with a ventilation monitor over the central hallway, they help provide cross ventilation.

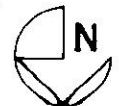
Solar heat is rejected through the use of a secondary light metal roof over the concrete roof slab and 1" rigid polyurethane insulation on all exterior walls and the roof. Both the east and west walls are protected from the sun by a series of silicon painted hollow core wood screens ("brise-soleil") fastened to the wide overhang by galvanized steel angles. South walls are shielded by a series of ivy-covered chain-link sunscreens. Service areas have been located on the west side, keeping the humidity away from the house and acting as a buffer zone for the late afternoon sun.

A 50-gallon breadbox solar water heater is located over the master bedroom at the southernmost part of the house. Suggested landscaping includes grass for ground cover and some shade trees. Exterior finishes are mostly light-colored cement plaster with some accents of exposed concrete.

PLAN B

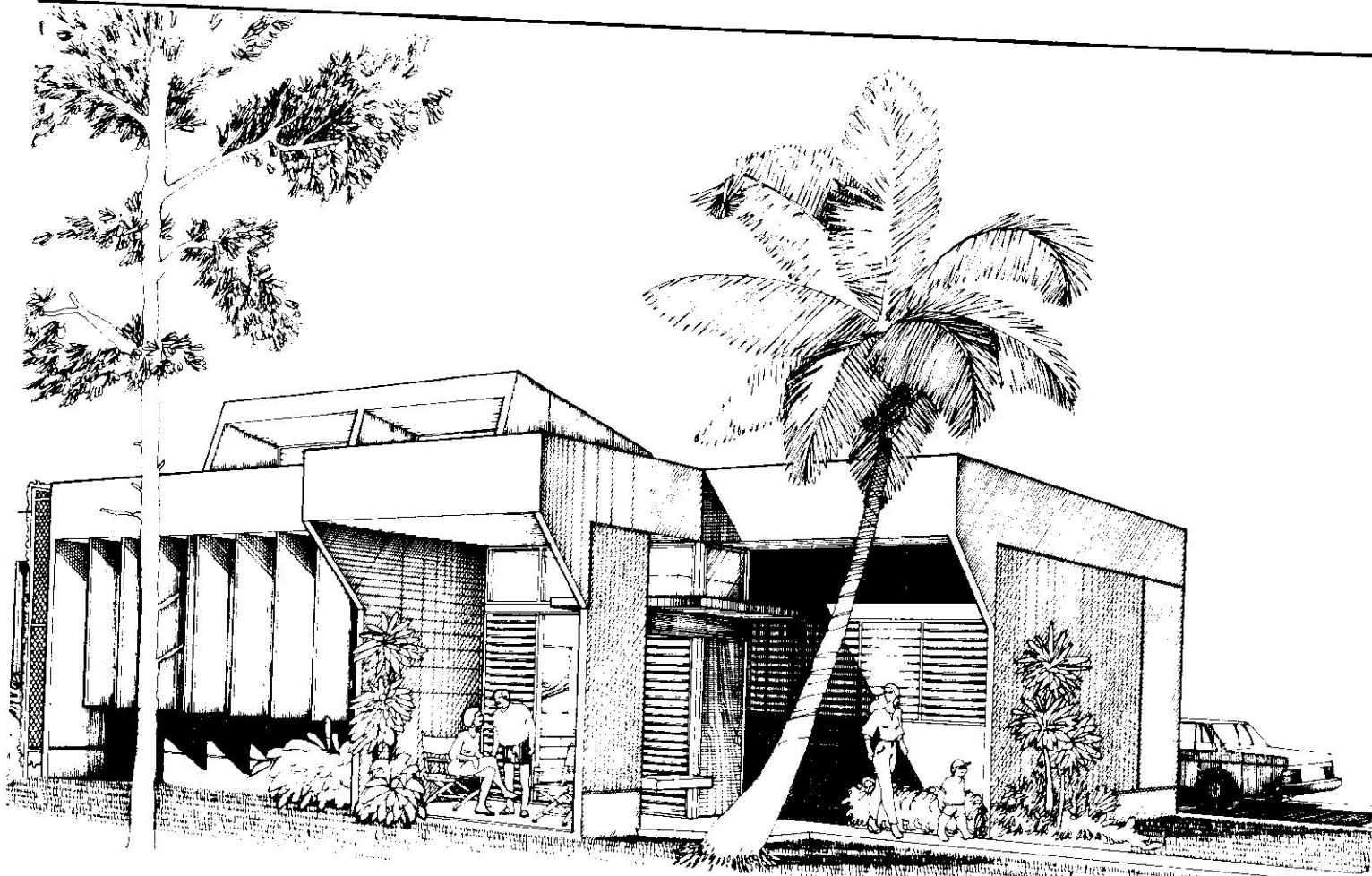


FLOOR PLAN 0 3 7 15 FEET

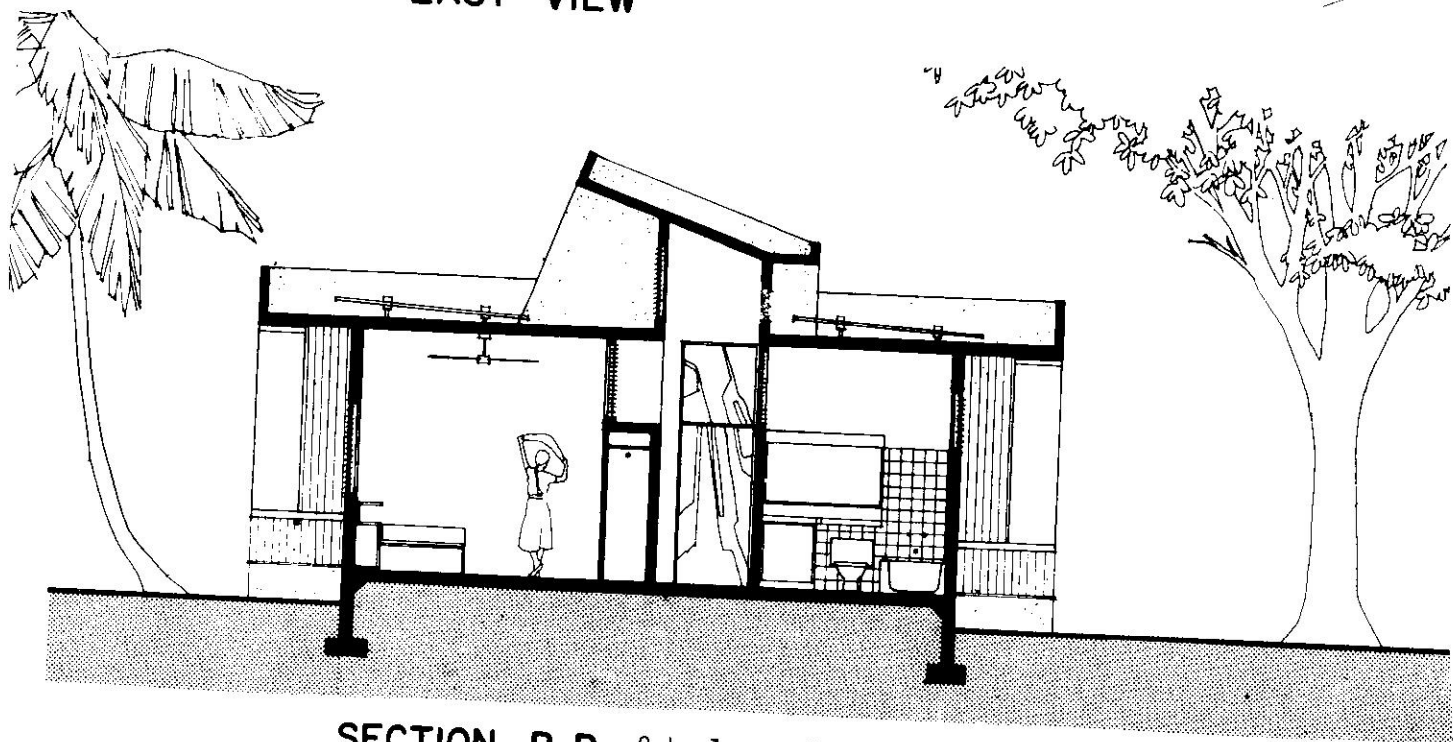


Plan B: Three Bedrooms, Two Baths

Low Energy Home Designs for Puerto Rico



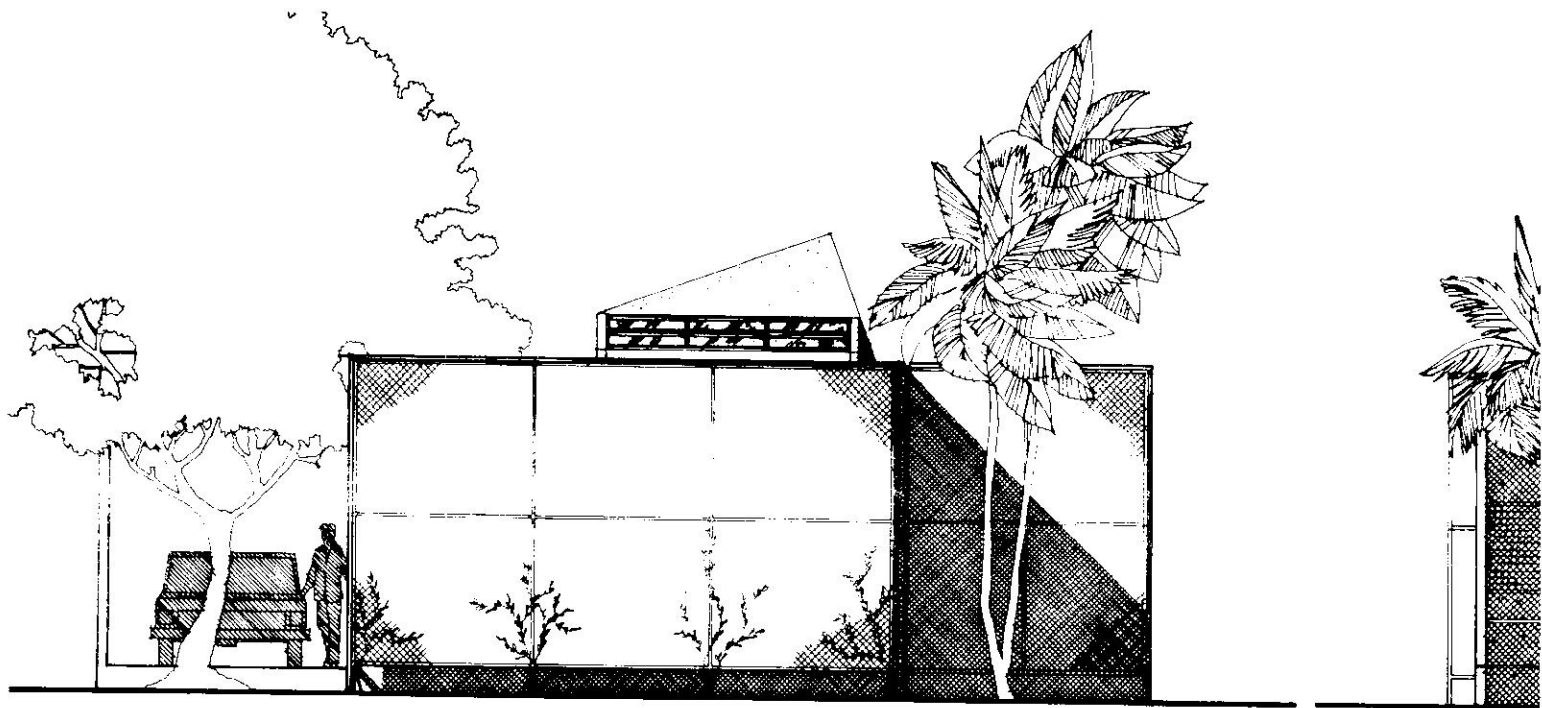
EAST VIEW



SECTION B-B 0 3 7 15 FEET

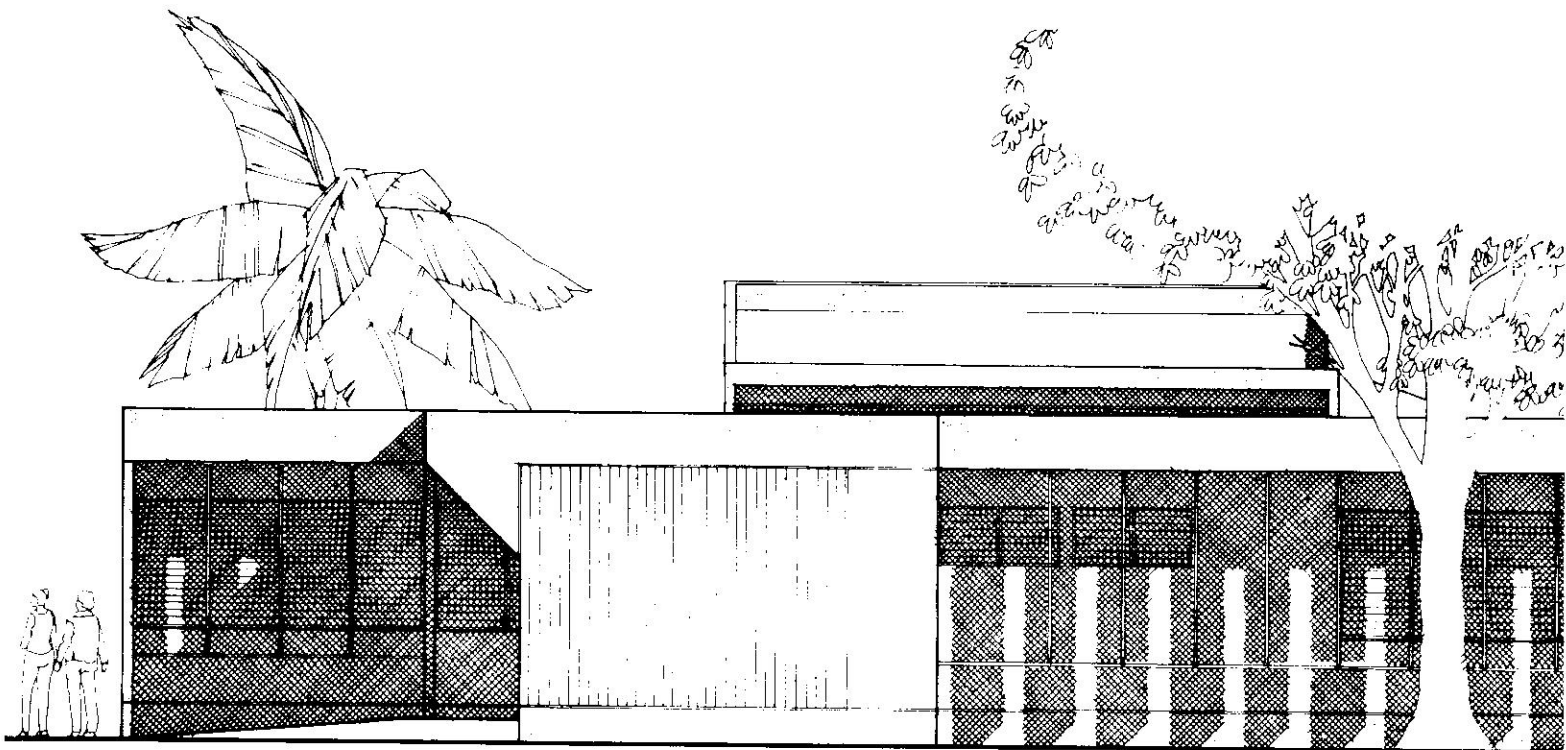
0 4 8 12 16 20
 SCALE IN FEET 1/8" 1'-0"

PLAN B (CONT.)

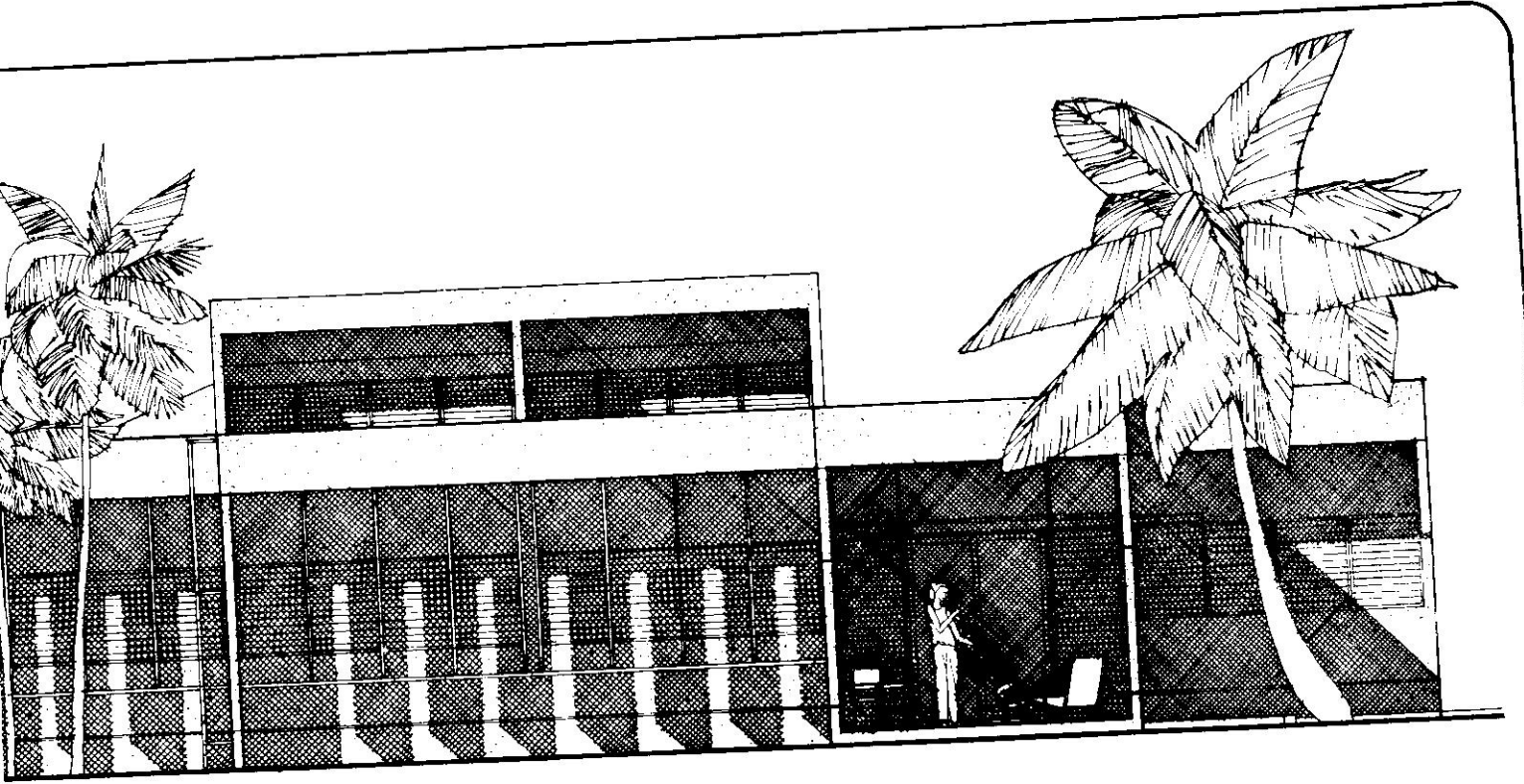


SOUTH ELEVATION 0 3 7 15 FEET

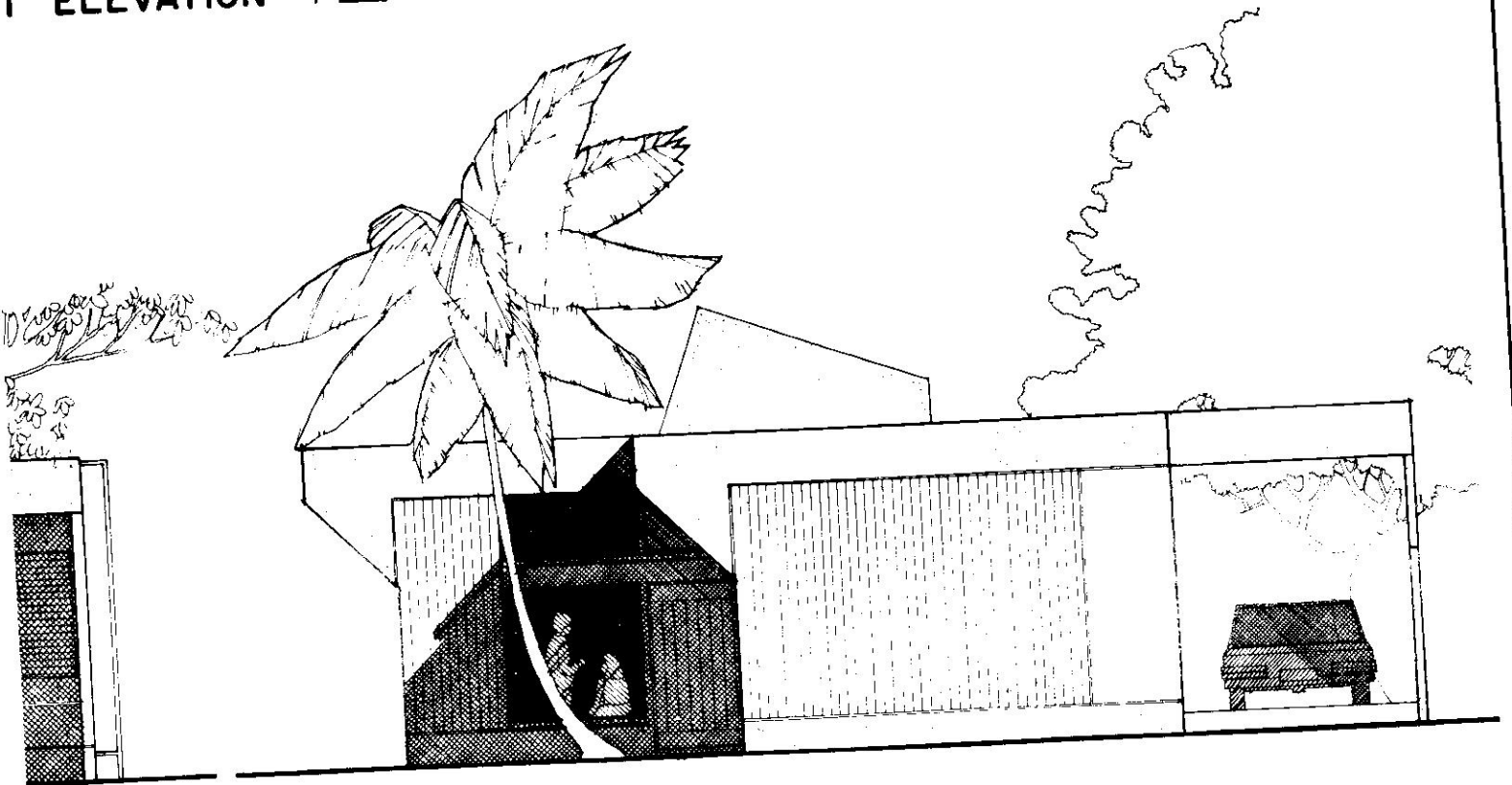
EAS



WEST ELEVATION 0 3 7 15 FEET



WEST ELEVATION 0 1 3 7 15 FEET



NORTH ELEVATION 0 1 3 7 15 FEET

Plan B

Plan C

**One story, 648 square feet
3 bedrooms, 1 bath
Attached or Detached**

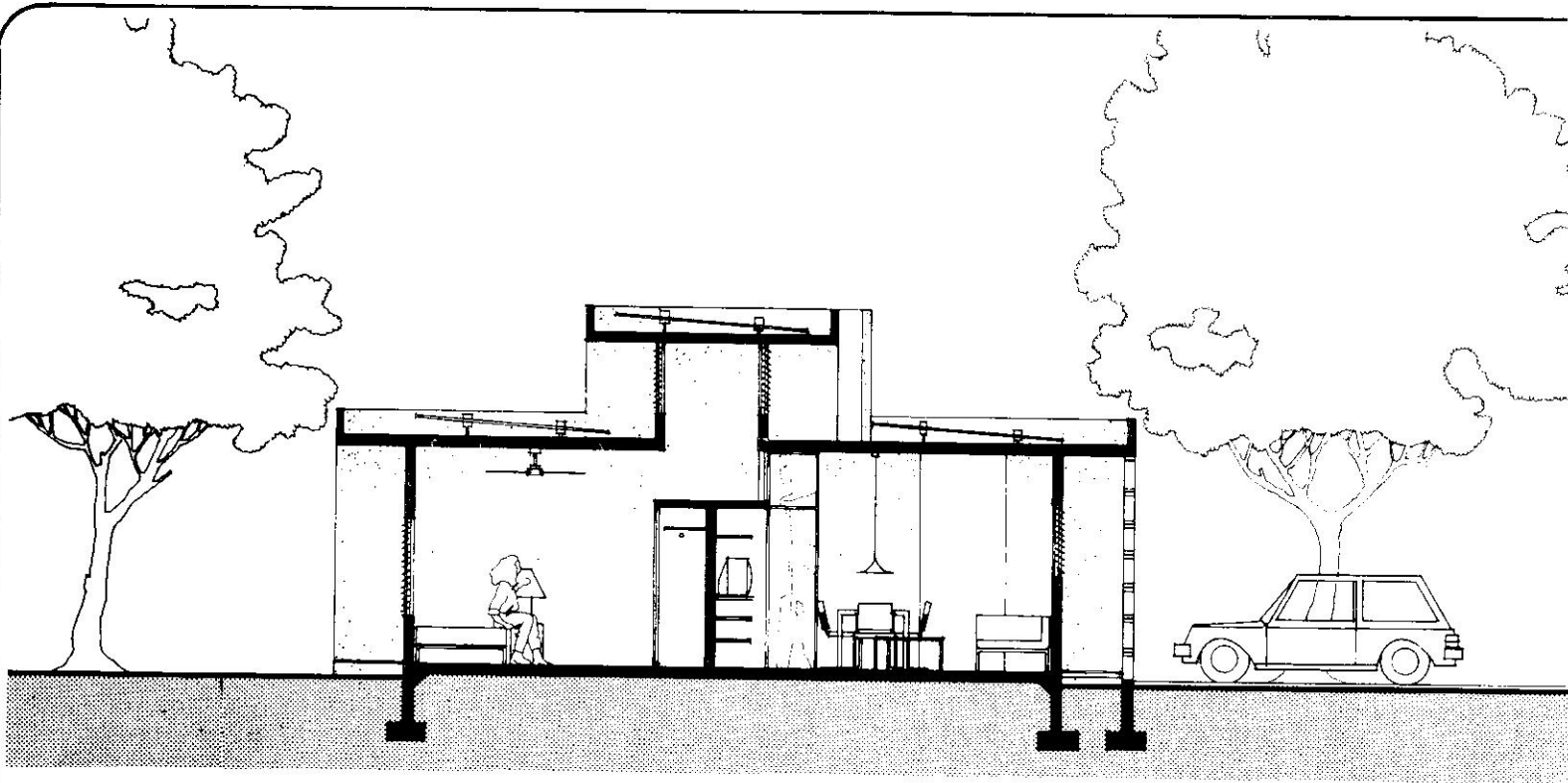
This house has been designed as a basic, compact unit. The layout is derived from traditional Puerto Rican residential architecture, with the main living areas occupying the center of the house and all other rooms branching off this central area. This arrangement precludes the use of circulation hallways.

The floor area of approximately 648 square feet accommodates three bedrooms and one bath. The house is 10 meters wide, the width of a typical urban rowhouse lot. Service areas are located on the south side.

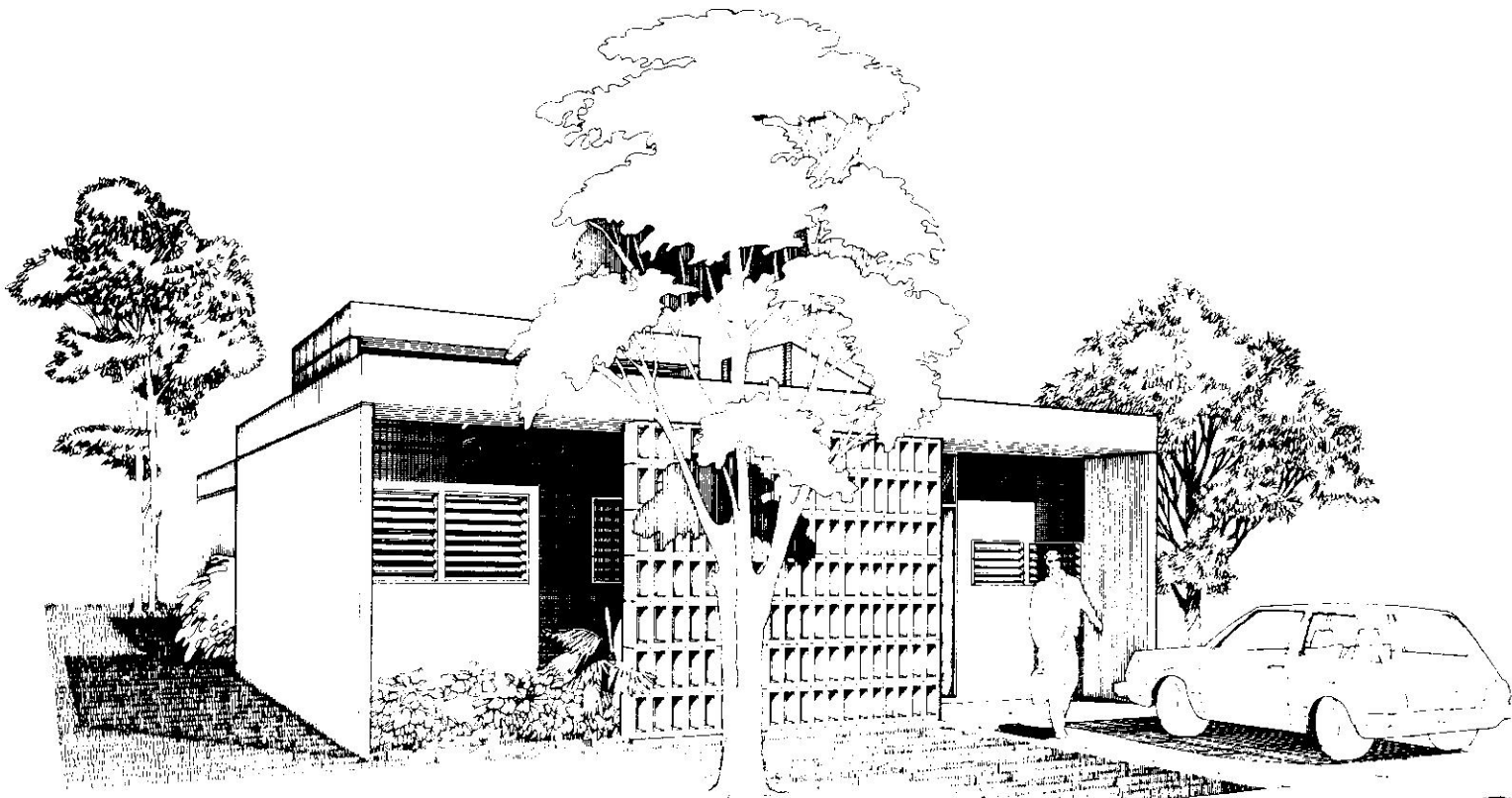
Cross ventilation is achieved through the use of wooden jalousie windows in combination with a ventilation monitor running north-south over low storage areas. An exterior terrace on the southeast corner, shaded by a canvas awning, provides additional living space. A 30-gallon breadbox solar water heater is located over the bathroom. A hollow concrete block grille shields the west wall from the late afternoon sun. In addition, the roof is protected by light metal panels acting as a secondary roof over the roof concrete slab, which in turn is insulated with 1-inch rigid polyurethane.

The exterior of the house is coated with cement plaster painted with light colors. Landscaping is limited and consists mostly of grass for ground cover and some shade trees for the east, south, and west areas.

PLAN C



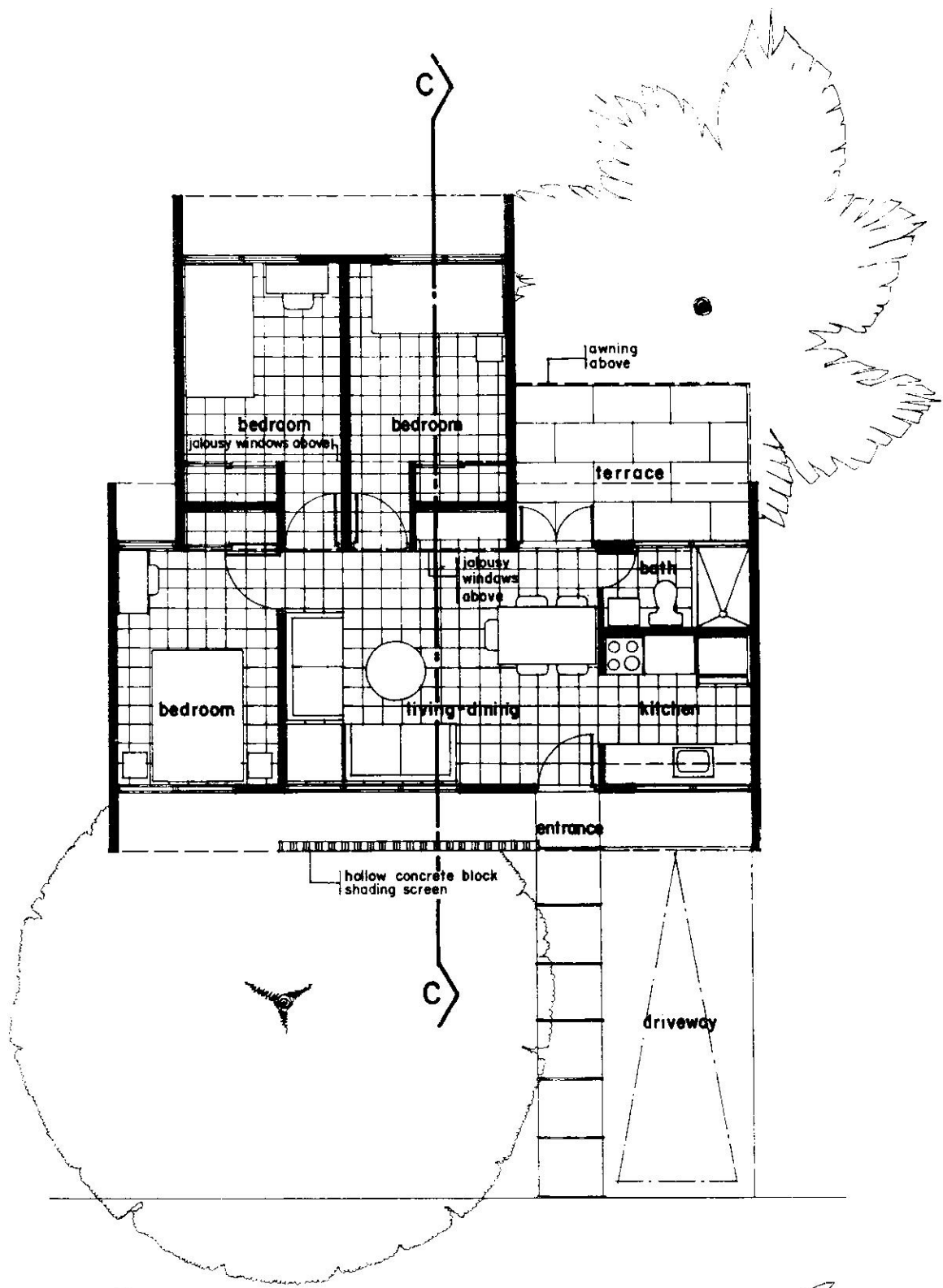
SECTION C-C 0 1 3 7 15 FEET



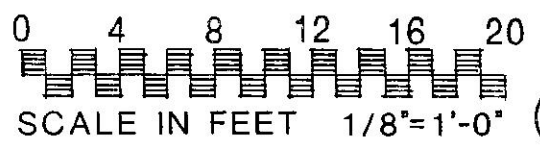
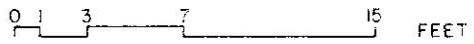
WEST VIEW

Plan C: Three Bedrooms, One Bath

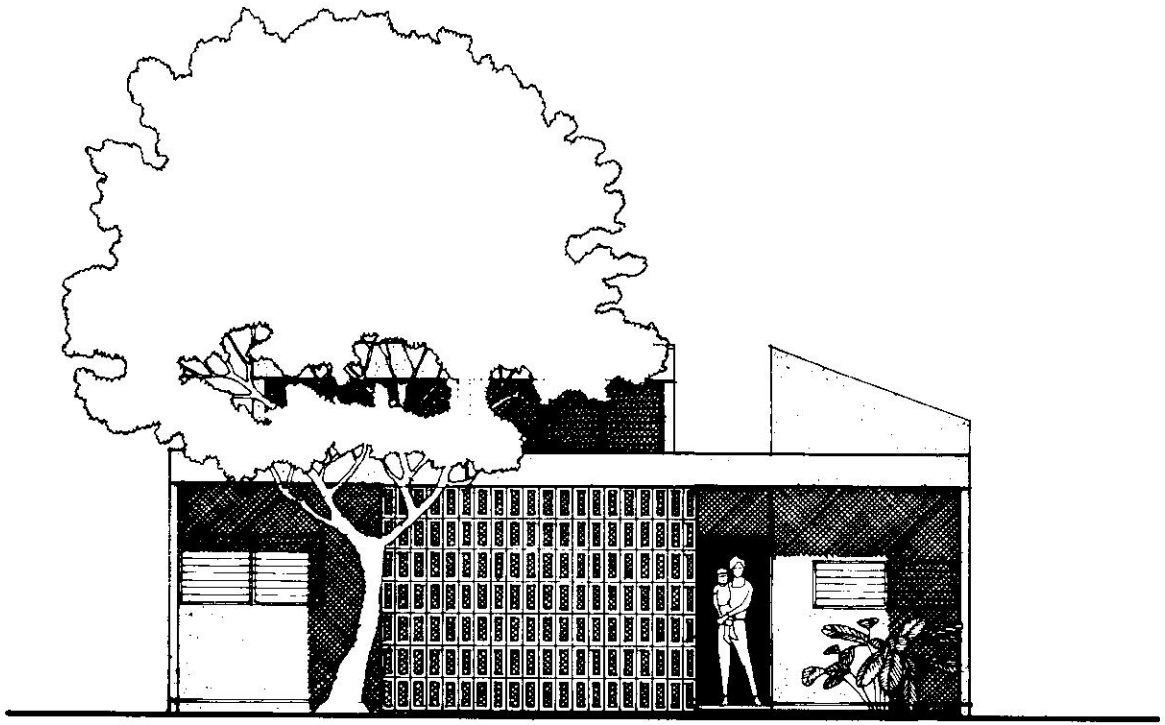
Low Energy Home Designs for Puerto Rico



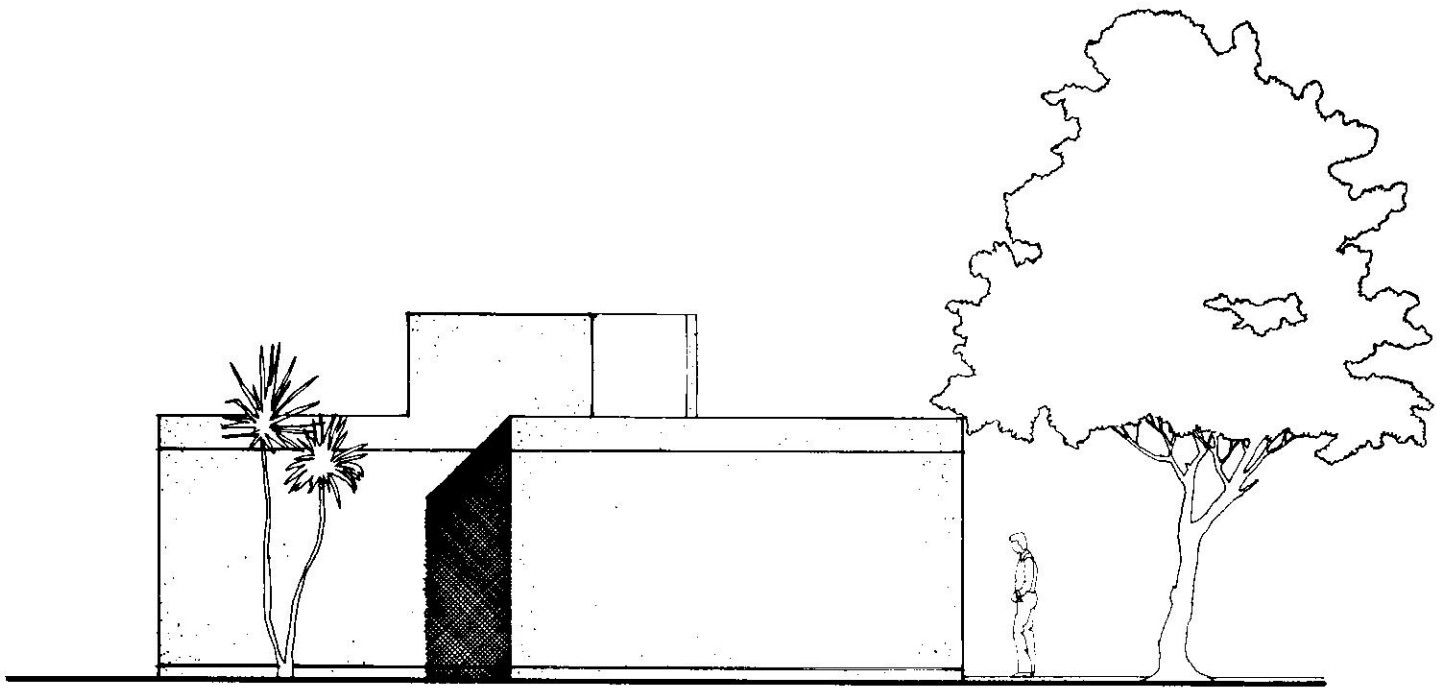
FLOOR PLAN



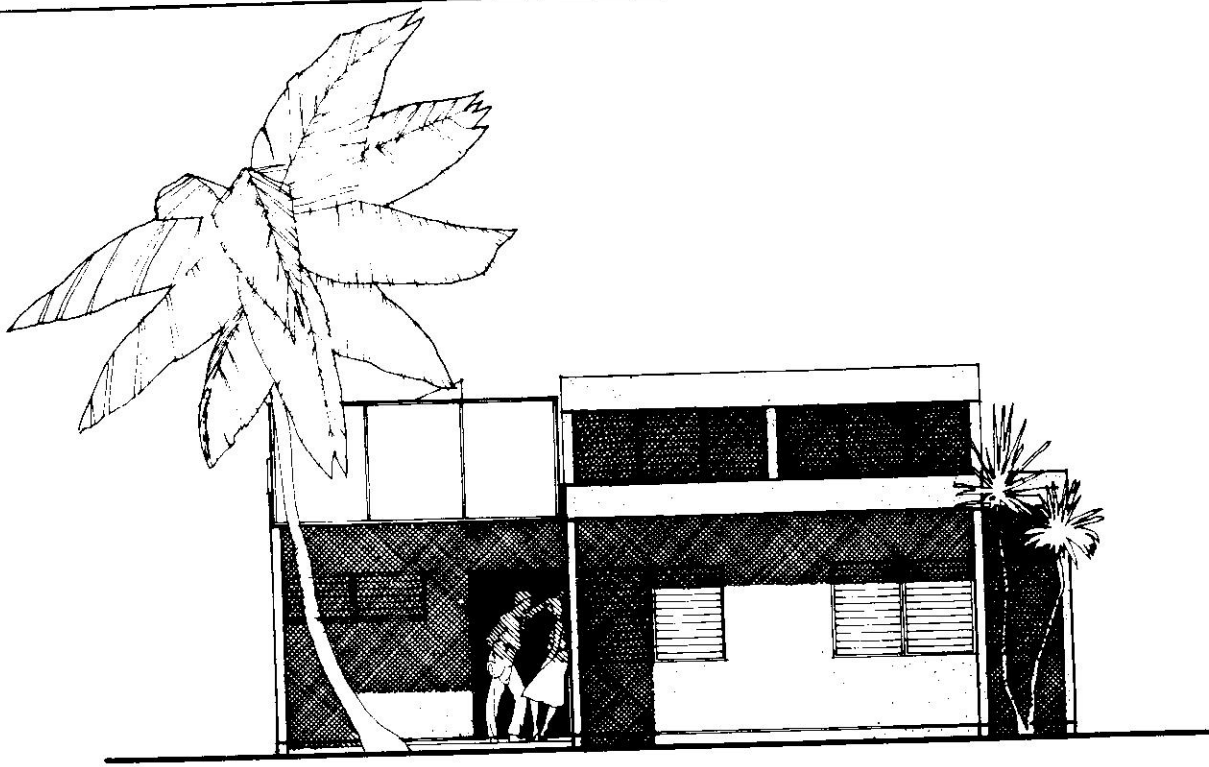
PLAN C (CONT.)



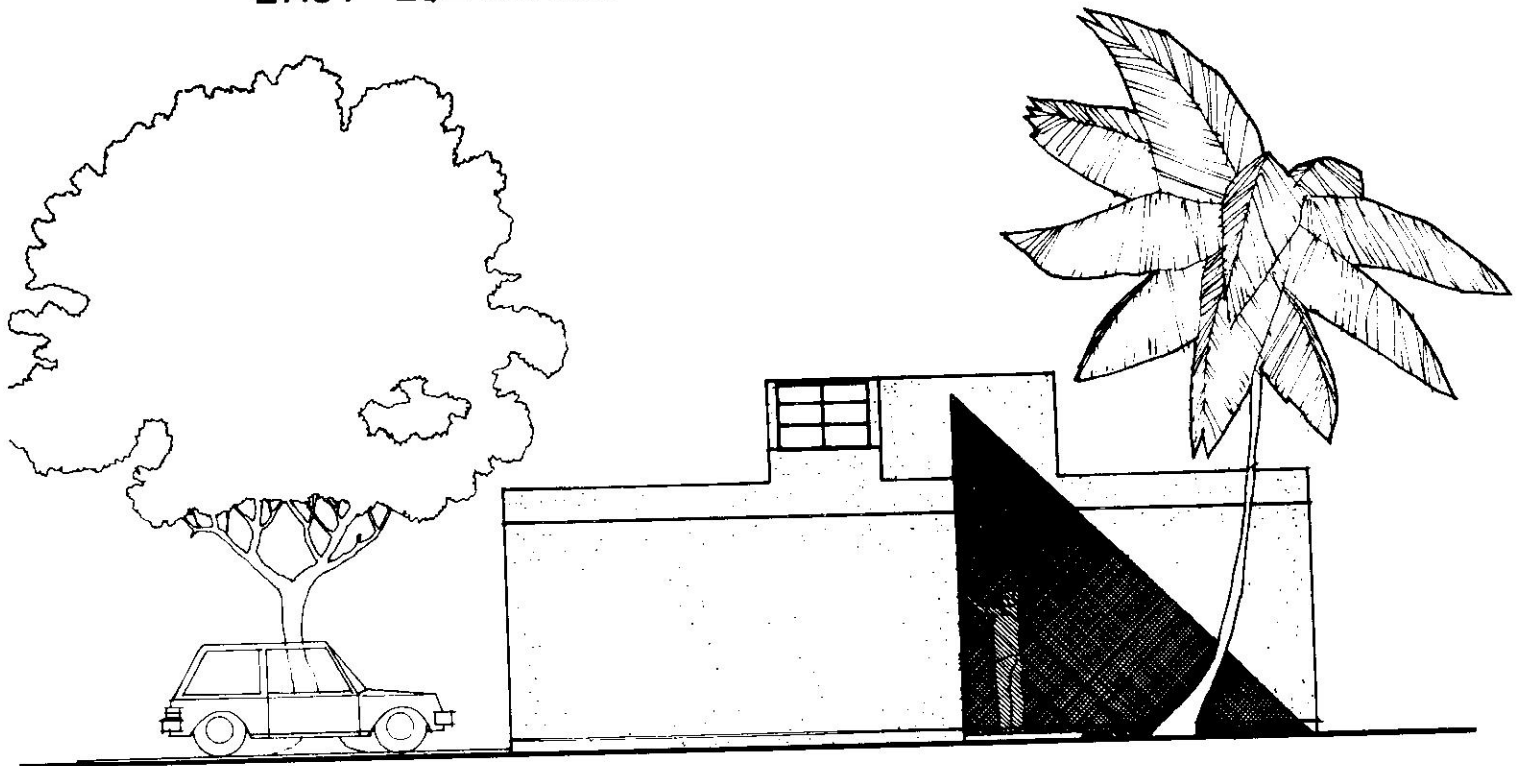
WEST ELEVATION 0 1 3 7 15 FEET



NORTH ELEVATION 0 1 3 7 15 FEET



EAST ELEVATION 0 1 3 7 15 FEET



SOUTH ELEVATION 0 1 3 7 15 FEET

Plan C