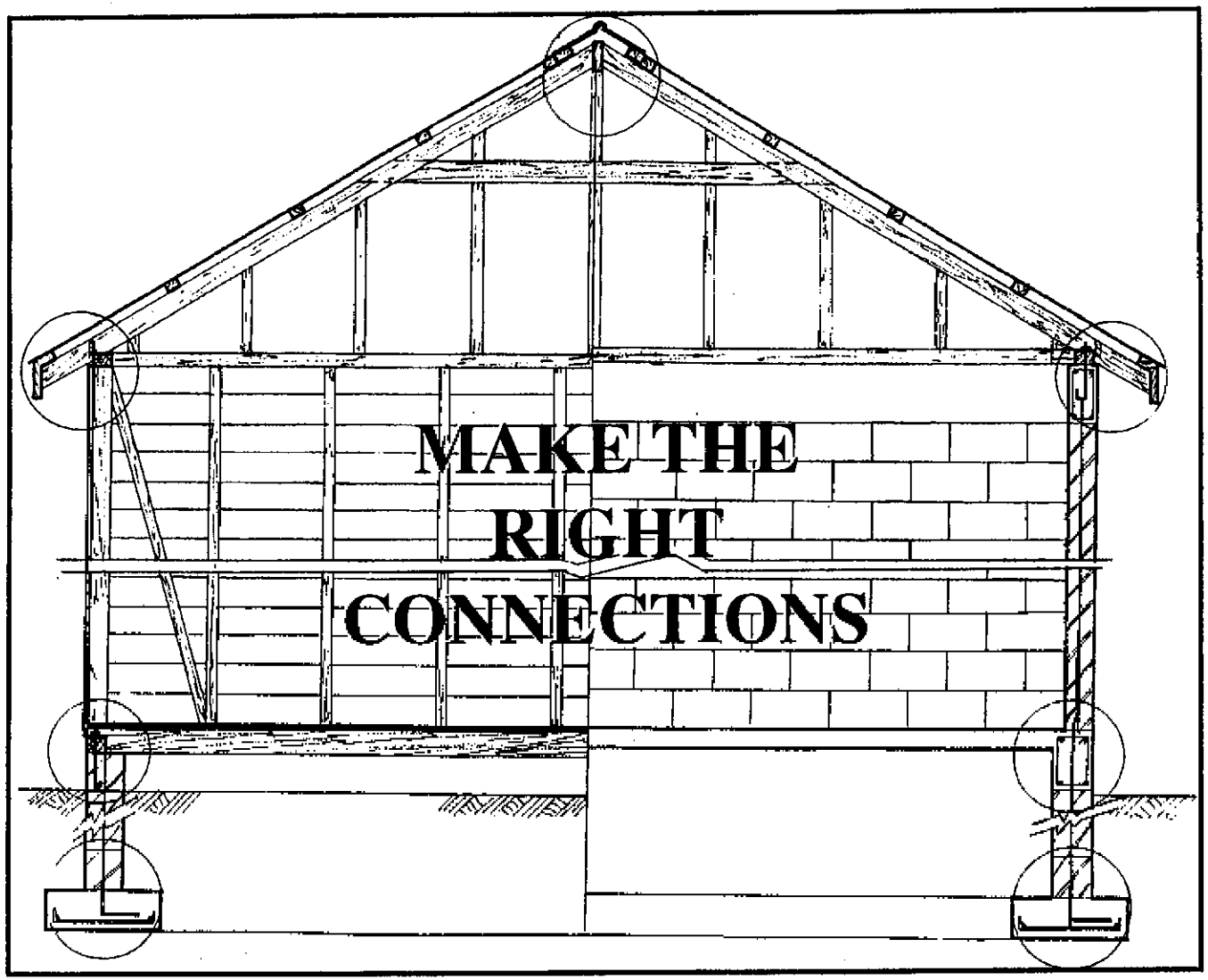
Appendix I.

Technical Booklet - *Make the Right Connections*

The following booklet, *Making the Right Connections,* was produce in Dominica by the Safe Shelter Initiative and the National Development Foundation of Dominica, with funding support from the Caribbean Disaster Mitigation Project. It is reprinted here with permission of the National Development Foundation of Dominica.

USAID

OAS



MAKE THE RIGHT CONNECTIONS

A manual on Safe Construction Techniques prepared as part of the OAS/USAID Caribbean Disaster Mitigation Project (CDMP)

NDFD
BUILDING DOMINICA

Material prepared by
CRDC - Kingston, Jamaica
SSI - Roseau, Dominica

Produced by
Safe Shelter Initiative
and
National Development Foundation of Dominica

SSI

PREFACE

The publication of this booklet forms part of the Informal Housing Retrofit and Safe Construction Pilot Project administered in Dominica by the National Development Foundation of Dominica (NDFD) with technical input from Safe Shelter Initiative (SSI).

The Project is sponsored by the Caribbean Disaster Mitigation Project (CDMP), a regional disaster mitigation project being implemented by the OAS Department of Regional Development and Environment (DRDE), in conjunction with the Regional Housing & Urban Development Office, Caribbean (RHUDO/CAR), located in the USAID Jamaica Mission, and USAID missions in the region. CDMP is funded by the Office of Foreign Disaster Assistance of the U.S. Agency for International Development.

The objective of CDMP is to establish public/private sector mechanisms for disaster mitigation which measurably lessen the loss of life, reduce physical and economic damage, and shorten the disaster recovery period. The project addresses some of the major issues in the disaster-development linkage in the Caribbean: the need to reduce natural hazard vulnerability in existing and planned development in order to achieve sustainable growth; mapping of hazard prone and environmentally fragile areas and the use of information in public awareness and development decision-making; and, the capacity of the insurance industry to better manage risk and maintain adequate catastrophe protection for the region.

The Informal Housing Retrofit and Safe Construction Pilot Project is a two year activity, the primary goal thereof being to assist governments, contractors, artisans and small builders throughout the Eastern Caribbean to adopt appropriate and cost effective hurricane vulnerability reduction measures in the informal housing sector. The project implemented in Dominica has three main components: (1) Public awareness, (2) Training of persons involved in the construction industry, particularly, small builders and (3) A revolving loan fund for house retrofitting. Seed financing for the loan program is provided by the Cooperative Housing Foundation (CHF) based in Maryland, USA.

The terms of reference are:

1. study the technical aspects and cost effectiveness of the retrofitting program and prepare appropriate training material for use in the Project.

2. design and carry out public education and awareness campaign at the national level.

3. organize and administer training workshops for builders, artisans and homeowners in selected communities.

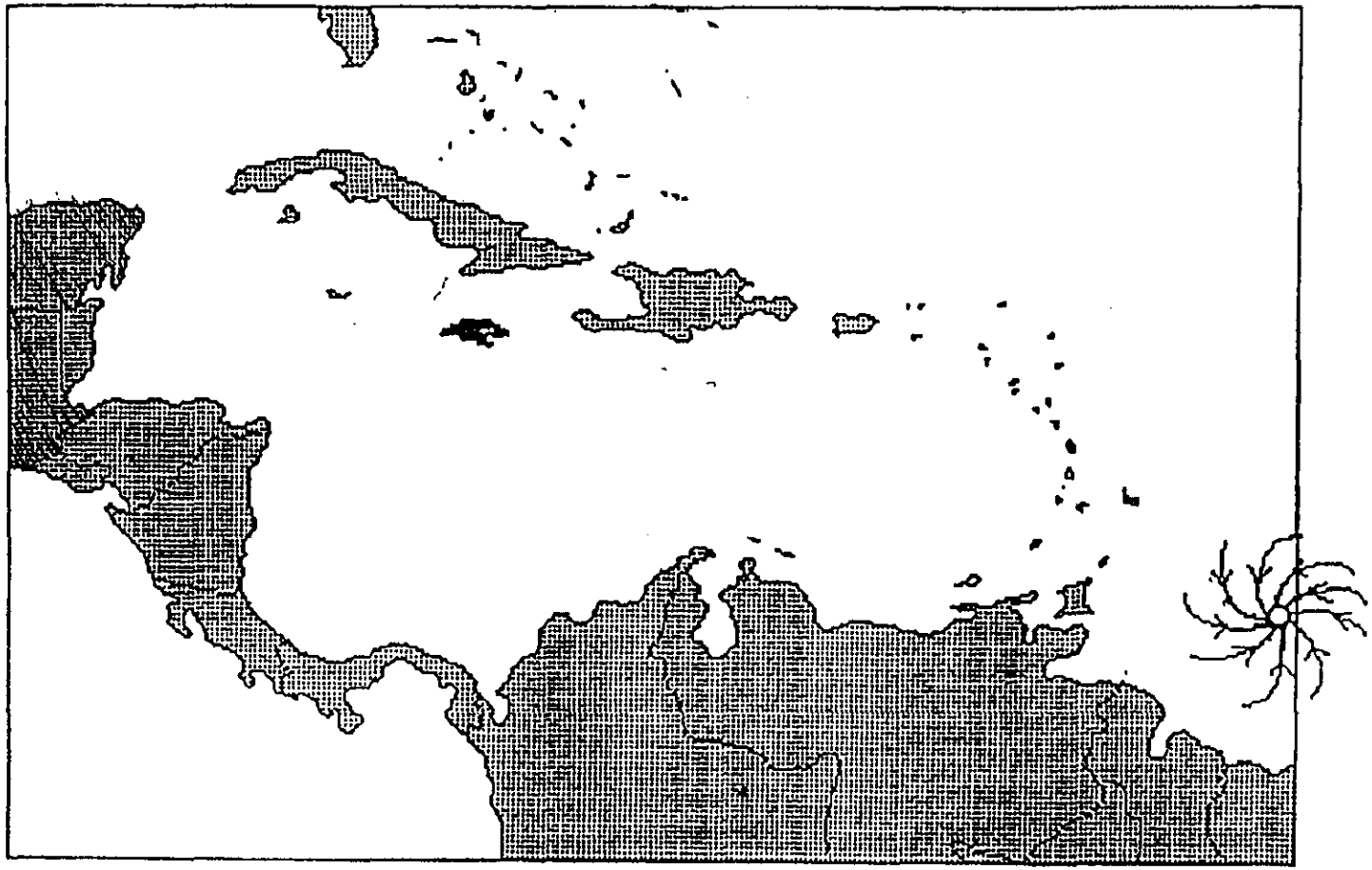
4. develop a series of practical training manuals targeting specific aspects of safe construction and function of buildings.

The information presented in this booklet is intended to assist homeowners and small builders in the informal housing sector in applying safety measures for reducing housing vulnerability when building or retrofitting.

MAKE THE RIGHT CONNECTIONS

HURRICANES

A HURRICANE IS A SWIRL OF WIND WHICH MOVES AS IT TURNS WITH THE HIGHEST WINDS NEAR THE CENTRE. THE CENTRE IS CALM AND IS CALLED THE EYE.



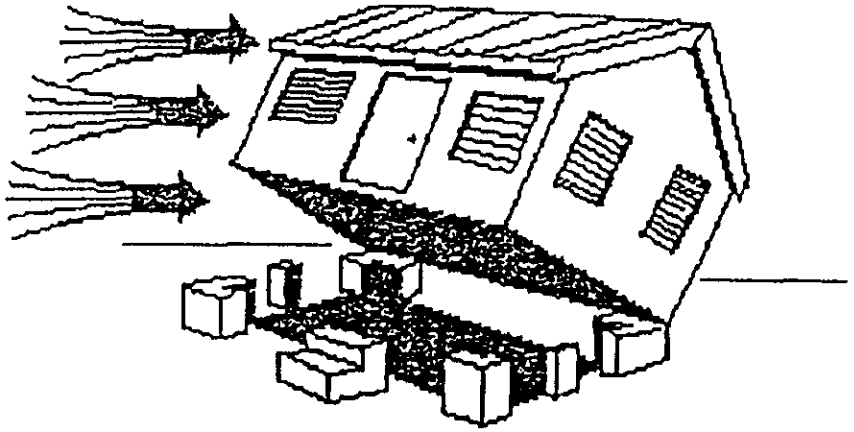
The wind can come from any direction

You may get a lull as the eye passes over.

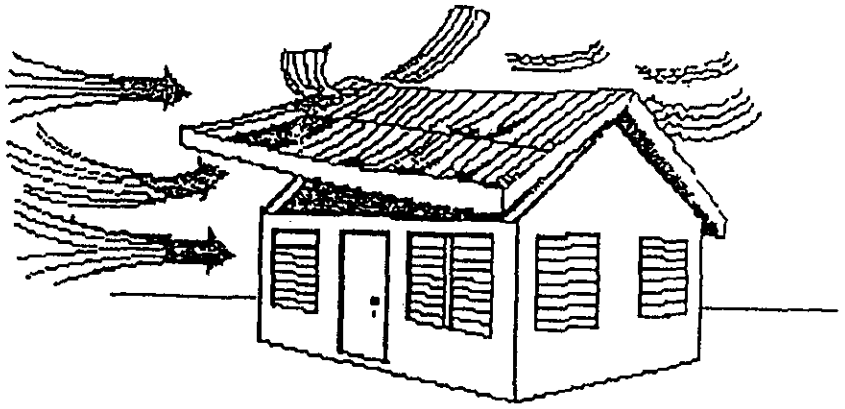
After the eye passes, the wind will come again from a different direction.

HURRICANES AFFECT HOUSES BECAUSE OF ENORMOUSLY POWERFUL WINDS.

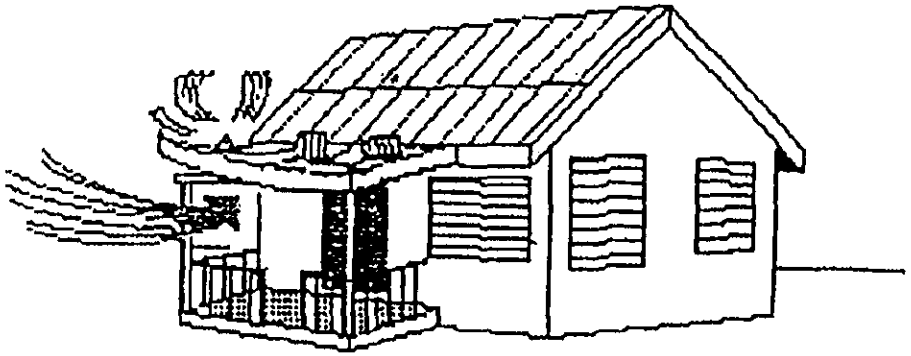
THEY CAN:



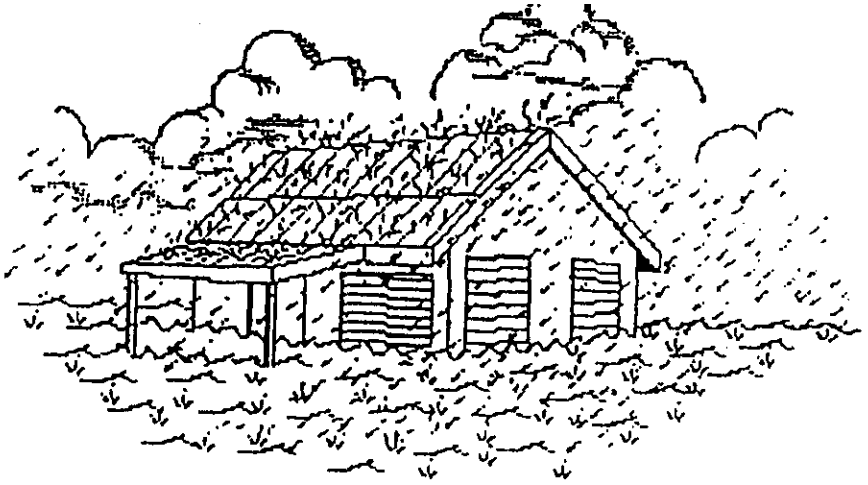
(1) Blow it off its footing



(2) Take off the roof

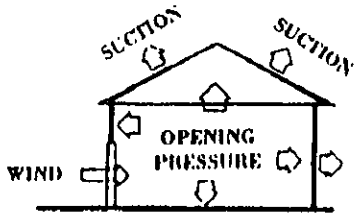


(3) Remove verandah and garage roofs

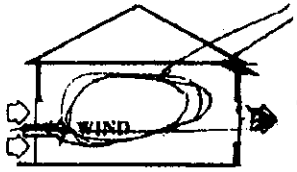


(4) Cause flooding because of heavy rains.

MAKE THE RIGHT CONNECTIONS



Wind generating opening on the windward side during a hurricane will increase the pressure on the internal surfaces. This pressure, in combination with the external suction, may be sufficient to cause the roof to blow off and the walls to explode.



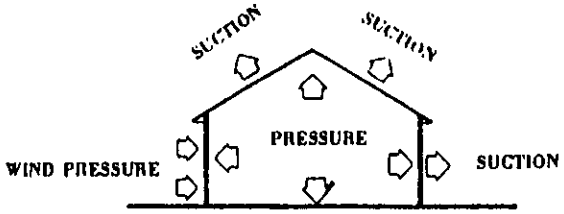
Corresponding opening on the leeward side

During a hurricane an opening may suddenly occur on the windward side of the house.

The internal pressure which builds up as a result may be relieved by providing a corresponding opening on the leeward side.

Failure of the Wall

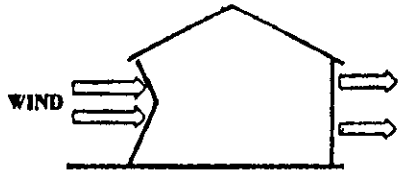
Wind forces on the walls of the house may produce failure.



Wind striking a building produces pressure which pushes against the building, on the windward side, and suction which pulls the building on the leeward side and the roof.

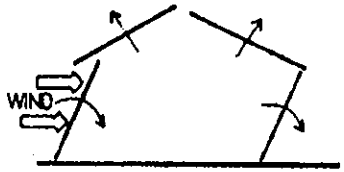
If no air enters the building, then there is pressure inside which is pushing against the walls and the roof.

HURRICANES



Windward face of the building collapses under pressure of windforce

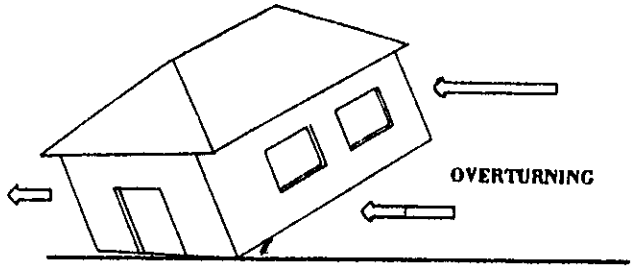
Another mode of failure occurs when the windward side of the house collapses under the pressure of the wind.



RACKING

Collapse starts at the roof building leaning in the wind direction

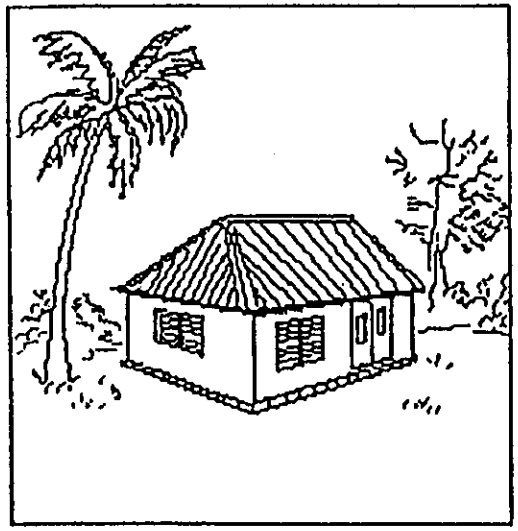
If the building is not securely tied to its foundations, and the walls cannot resist to push/pull forces the house tends to collapse starting the roof with the building leaning in the direction of the wind.



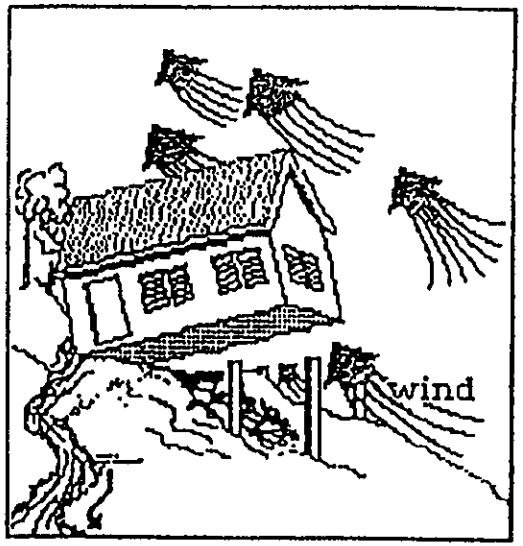
Overturning is another problem for light structures. This occurs when the weight of the house is insufficient to resist the tendency of the hose to be blown over.

All modes of failure can be avoided by bracing timber structures and reinforcing the concrete walls.

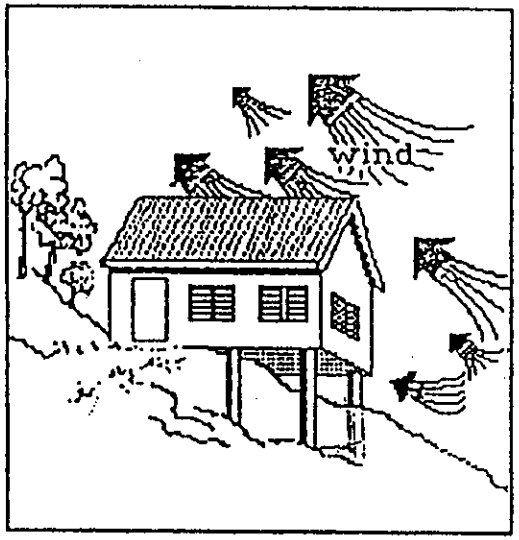
WHEN CHOOSING A SITE FOR YOUR HOUSE, CONSIDER THE FOLLOWING:-



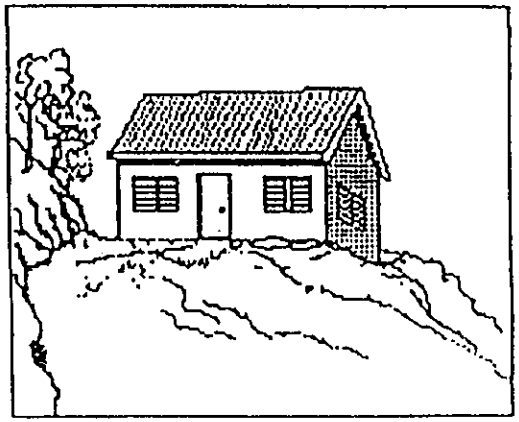
A house is best built on a flat firm site provided it is *well drained*



The wind and water can dislodge the house.



If your lot is on a slope don't place the house like this *unless it is properly anchored.*

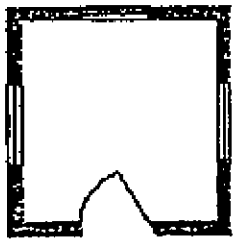


Cut and fill is a common means of levelling a house site. Avoid building on the fill. *Foundation should be on solid ground.*
This house is safer, cut into the side of the hill.

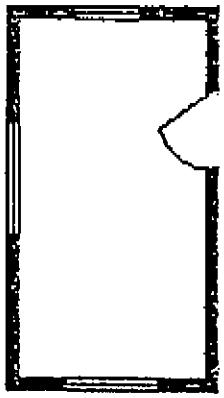
THE CHOICE OF HOUSE DESIGN IS ALSO VERY IMPORTANT IN MAKING IT DISASTER RESISTANT.

THE BEST SHAPE TO RESIST HIGH WINDS IS A SQUARE BECAUSE
- IT ALLOWS HIGH WINDS TO GO AROUND THEM.
- IT IS BETTER BRACED AGAINST EARTHQUAKES.

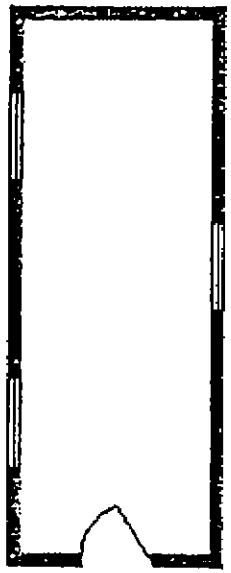
IF OTHER SHAPES ARE DESIRED EFFORTS SHOULD BE MADE TO STRENGTHEN THE CORNERS.



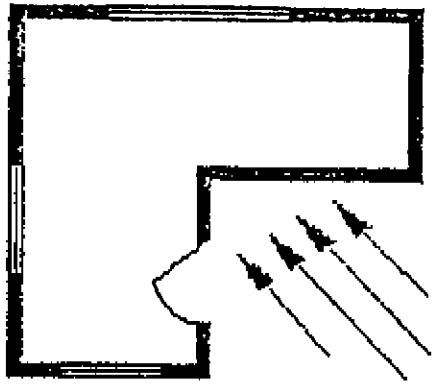
Square (Best)



Rectangle



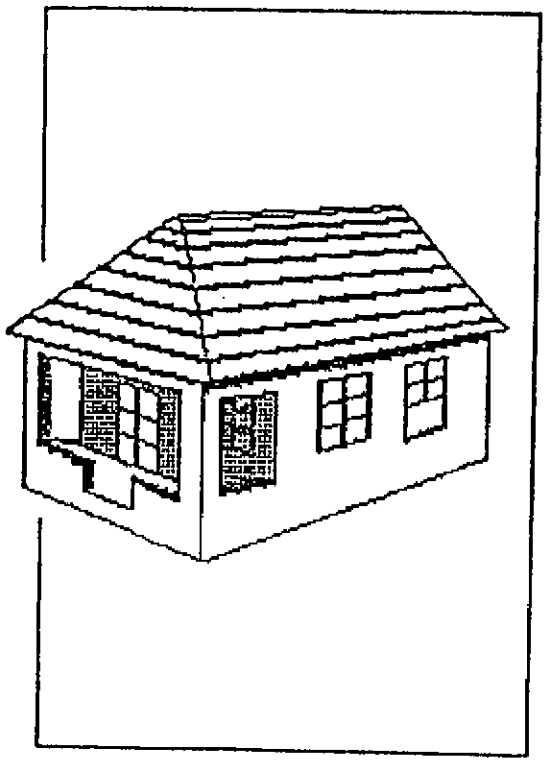
Long Rectangle



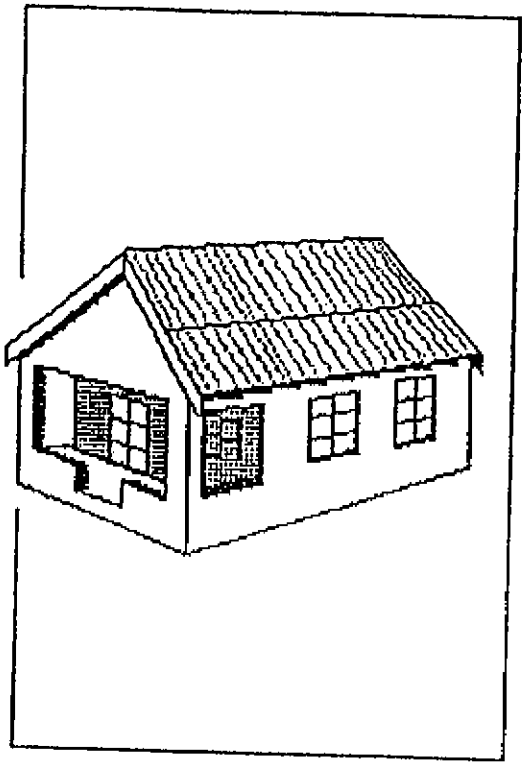
L-Shape

If longer shapes are used, they must be designed to withstand the forces of the wind.
Most houses are rectangular and the best layout is when the length is not more than three (3) times the width.

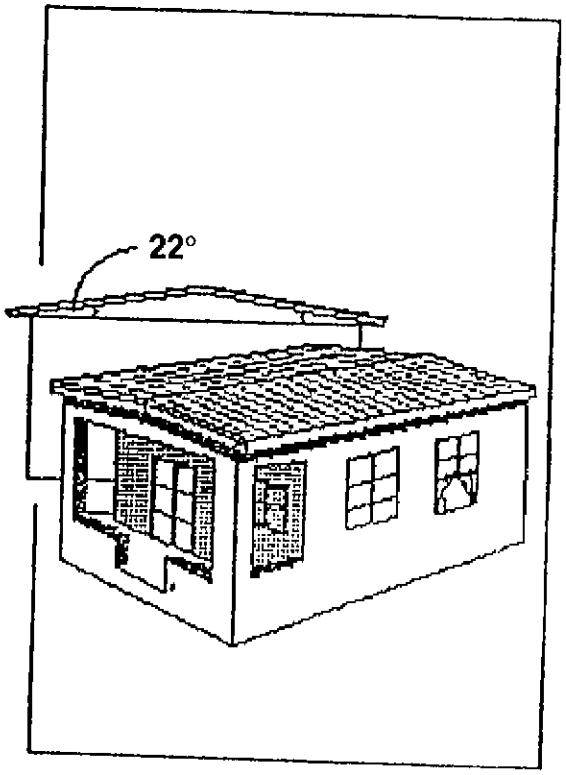
LIGHTWEIGHT FLAT ROOFS ARE EASILY BLOWN OFF IN HIGH WINDS. IN ORDER TO LESSEN THE EFFECT OF THE UPLIFTING FORCES ON THE ROOF, THE ROOF PITCH SHOULD NOT BE LESS THAN 22°. HIP ROOFS ARE GOOD, THEY HAVE BEEN FOUND TO BE MORE HURRICANE RESISTANT THAN GABLE ROOFS.



Hip roof



Gable roof



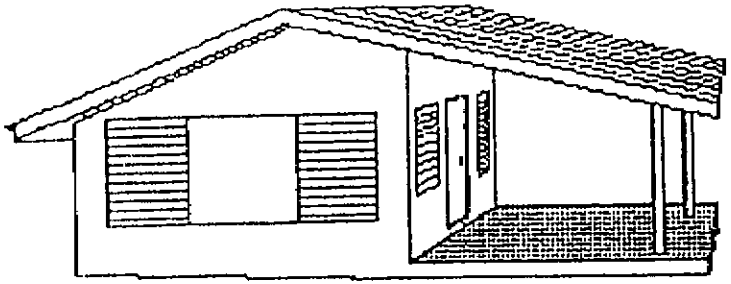
Flat roof

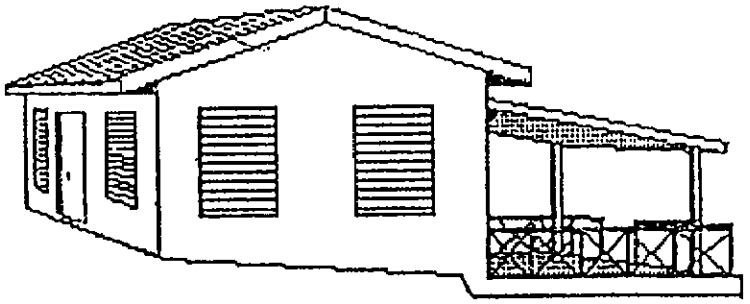
DESIGN CONSIDERATIONS

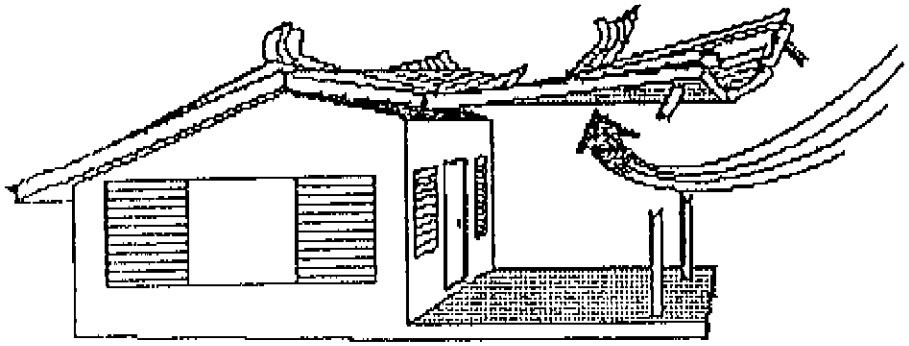
General

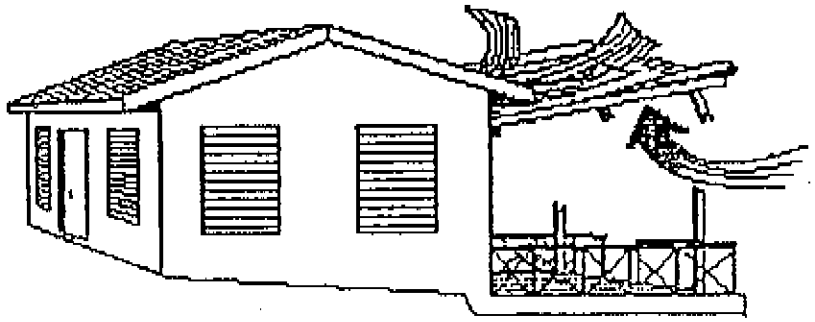
1. Avoid a low pitched roof, use a hip roof or a high pitched gable roof.
2. Avoid overhanging roofs. If overhangs or canopies are desired, they should be separated from the main roof structures.
3. Avoid openings which cannot be securely closed during a hurricane. Where openings are already in existence, hurricane shutters should be provided.
4. Best plan shape for wind resistance is a square or rectangle with length to width ration no more than 3:1.

OVERHANGS, PATIOS AND VERANDAHS EXPERIENCE HIGH WIND PRESSURES AND SHOULD BE KEPT SHORT AND SMALL.







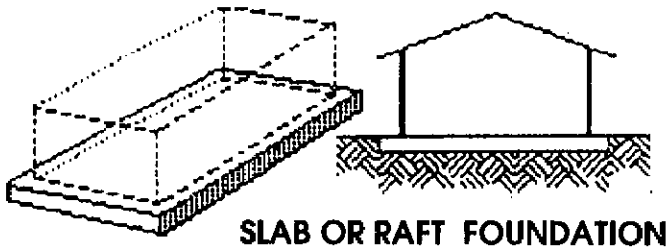


- **Avoid large overhangs as high wind force build up under them.**
- **Overhangs should not be more than 18 inches** *at verges or eaves.*
- **Build verandah and patio roofs as separate structures rather than extensions of the main building.**
- **They may blow off without damaging the rest of the house.**

FOUNDATIONS

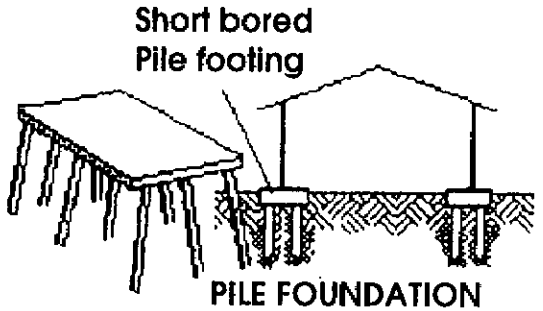
THE FOUNDATION IS THE PART OF THE HOUSE WHICH TRANSFERS THE WEIGHT OF THE BUILDING TO THE GROUND. IT IS ESSENTIAL TO CONSTRUCT A SUITABLE FOUNDATION FOR A HOUSE AS THE STABILITY OF A BUILDING DEPENDS PRIMARILY ON ITS FOUNDATION.

For low cost construction the main types of foundation are:



SLAB OR RAFT FOUNDATION

- Used on soft soils.
- Spread the weight over a wider area.

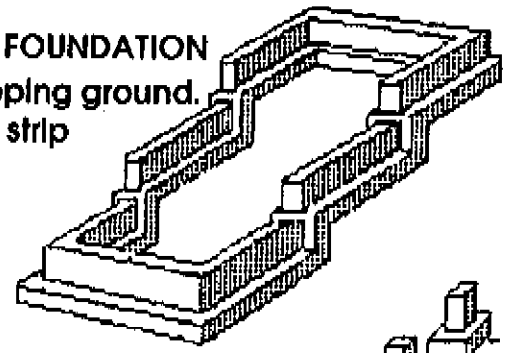


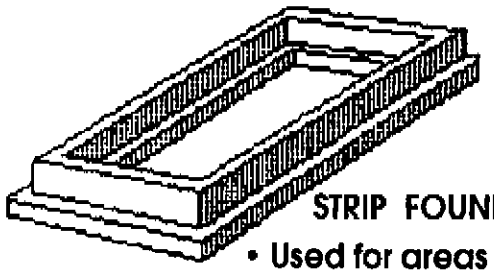
PILE FOUNDATION

- Are deep foundations for heavy buildings.
- Not often used in small buildings.

STEPPED FOUNDATION

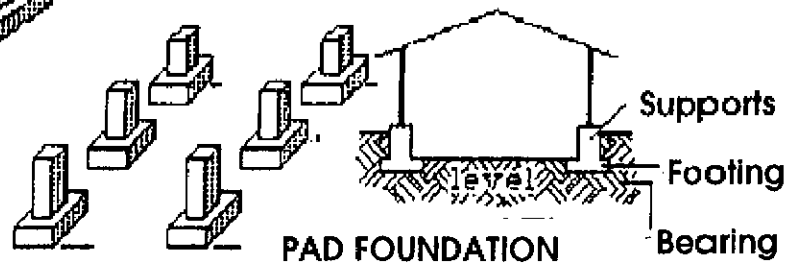
- Used on sloping ground.
- Is a form of strip foundation.





STRIP FOUNDATION

- Used for areas where the soil varies.
- Most common.
- Supports a wall.



PAD FOUNDATION

- Used on firm soil
- Used for columns and poles.

NOTE: Tie beams between pads are used in some islands of the Caribbean

CONSTRUCTION TECHNIQUES

Foundation

The functions of the foundations are:-

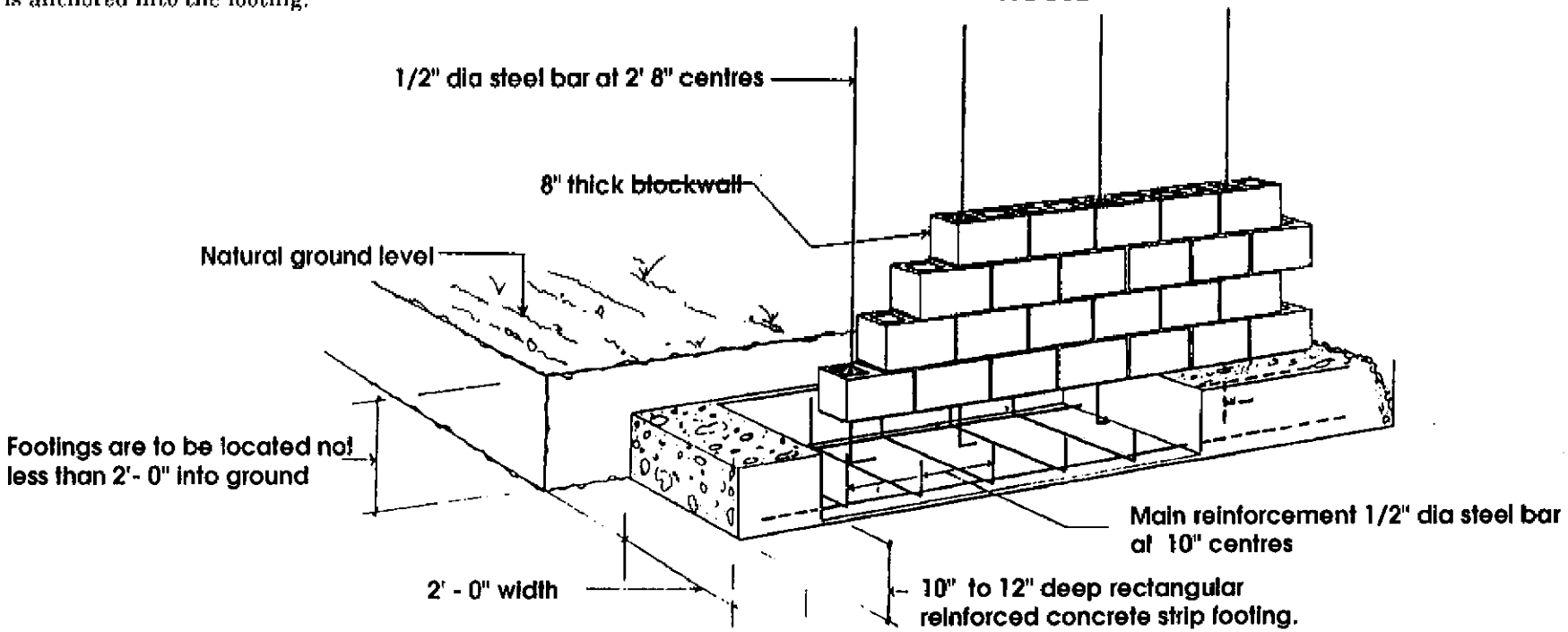
1. To securely anchor the house to the ground to prevent wind forces from lifting the entire building or blowing it over.

2. To transmit the building loads to the ground.
   Foundations should be securely connected to the rest of the structure and located not less than 2 feet into the ground on firm strata.

The foundation for the blockwall construction is usually a continuous rectangular reinforced concrete strip footing.

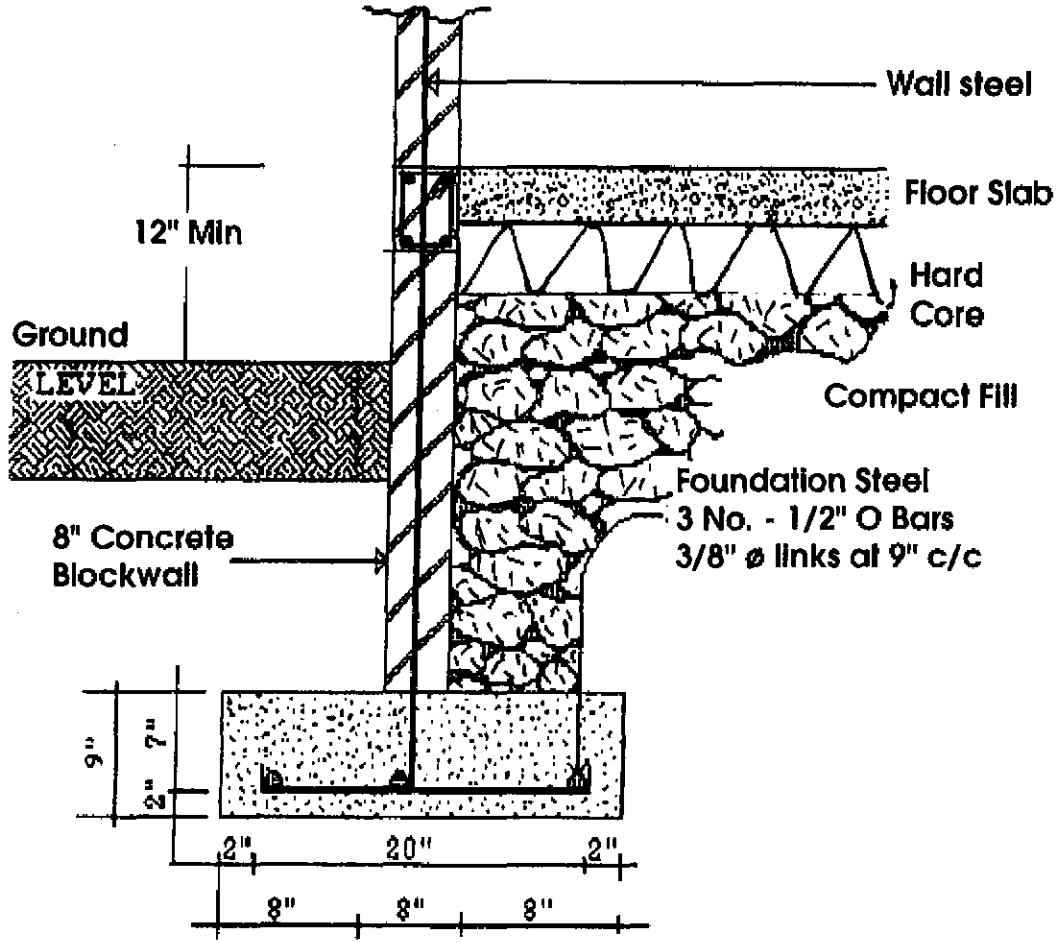
The blockwalls which are then built off this footing contain vertical reinforcement which is anchored into the footing.

STRIP FOOTING FOR CONCRETE BLOCKWORK HOUSE



REINFORCEMENT

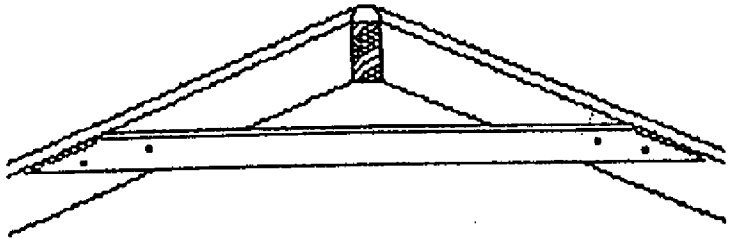
THE FOUNDATION FOR A CONCRETE BLOCK BUILDING SHOULD BE CONSTRUCTED OF CONCRETE WHICH MUST BE REINFORCED. THE REINFORCEMENT IN THE WALL TIED TO THAT OF THE FOUNDATION.



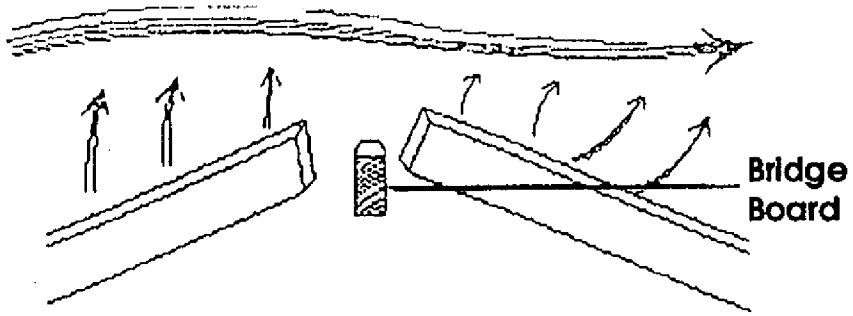
REINFORCEMENT TO STRIPFOOTING

THE ROOF

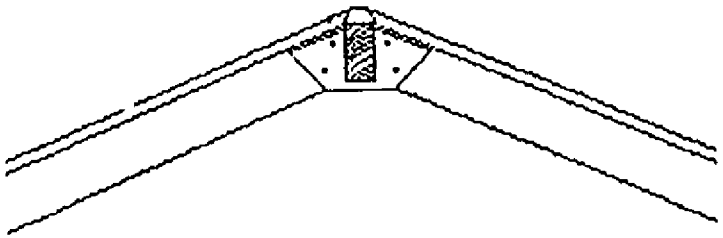
WHEN THE WIND PASSES OVER THE ROOF IT SUCKS THE ROOF UPWARDS AND THE RIDGE CAN PULL APART. THE RIDGE MUST BE HELD TOGETHER. THIS CAN BE DONE BY USING:-



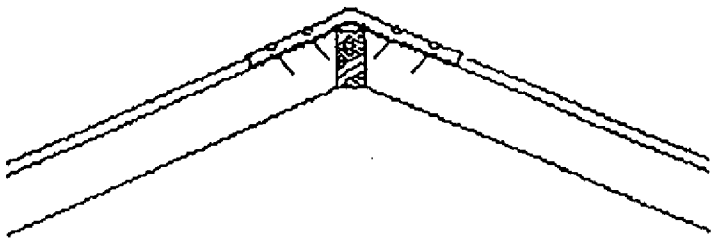
<u>COLLAR TIES</u> - Timbers connecting the rafters. Nail them to the side of the rafters, not the face or the nails will pull out.



If the rafters are not secure, the ridge can fall apart when strong wind passes over the roof.

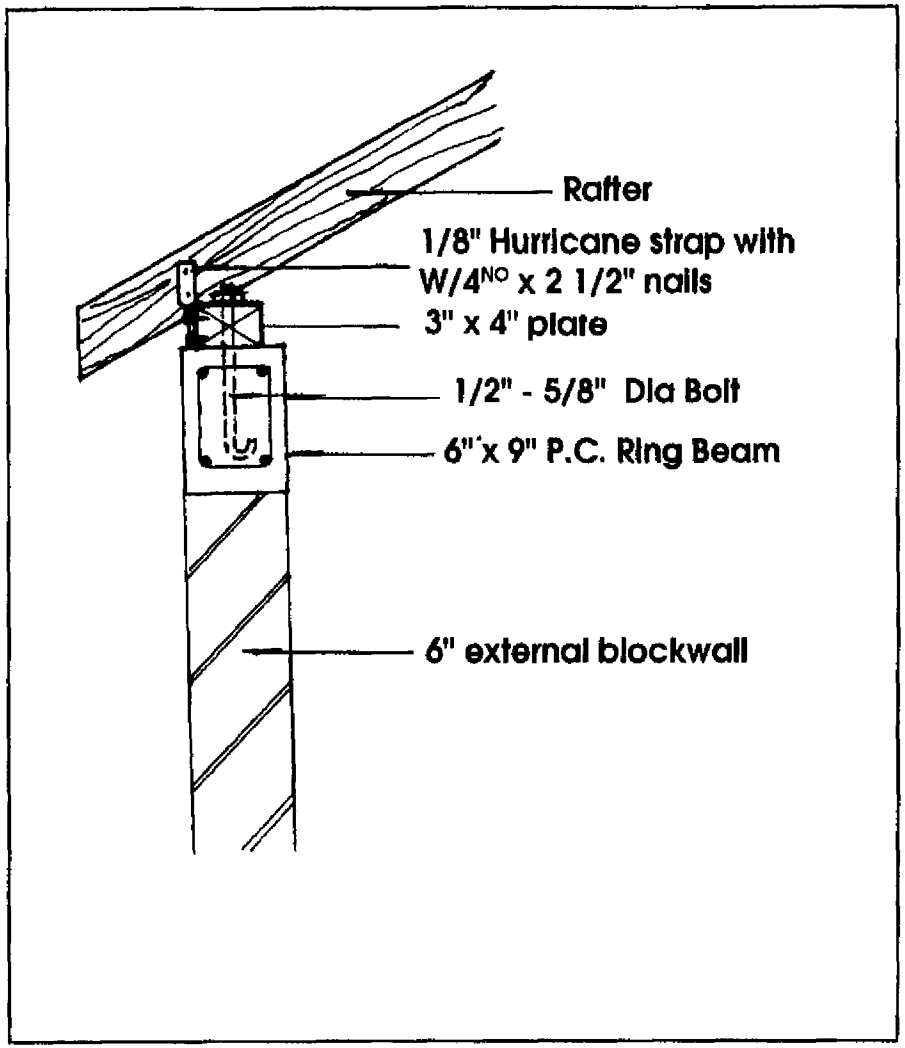


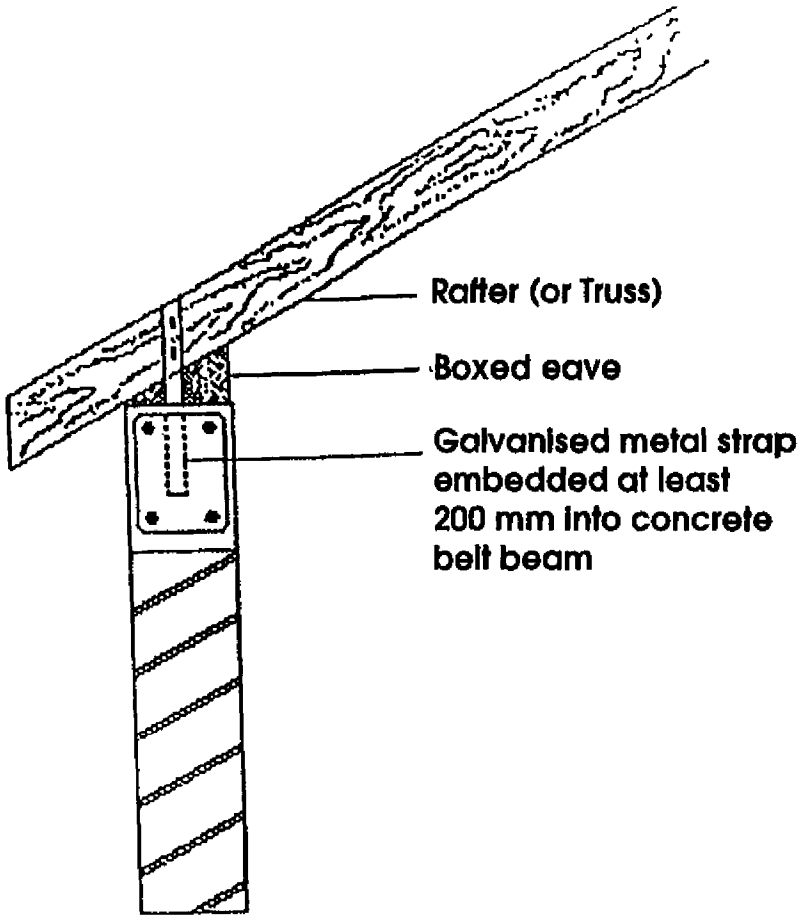
<u>GUSSETS</u> - Usually made of steel/plywood. This is used at the ridge.



<u>METAL STRAPS</u> over the top of the rafters.

ROOF CONNECTIONS FOR CONCRETE WALLS

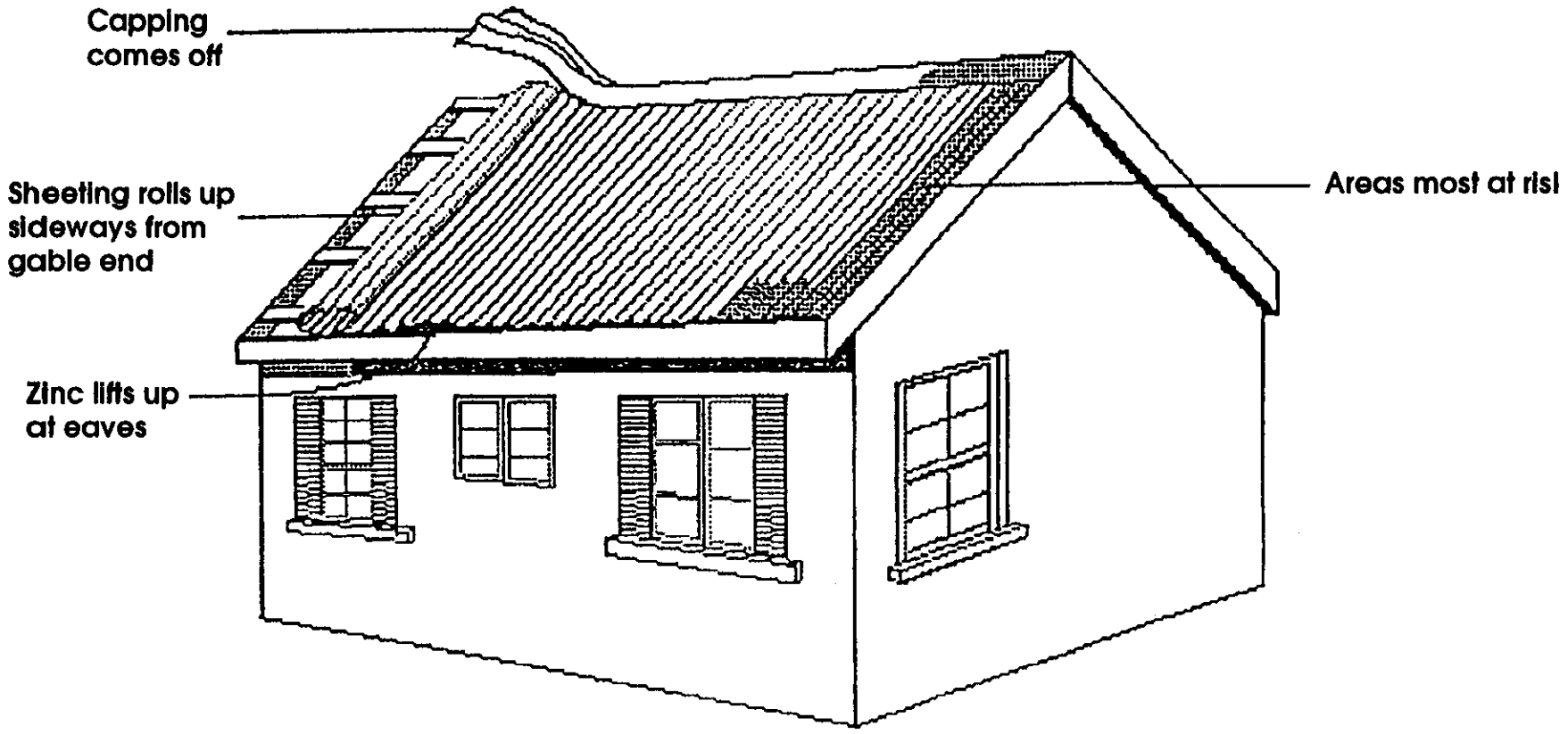




Galvanised metal strip embedded into concrete belt beam to hold down rafter. This is a good alternative to having a wallplate.

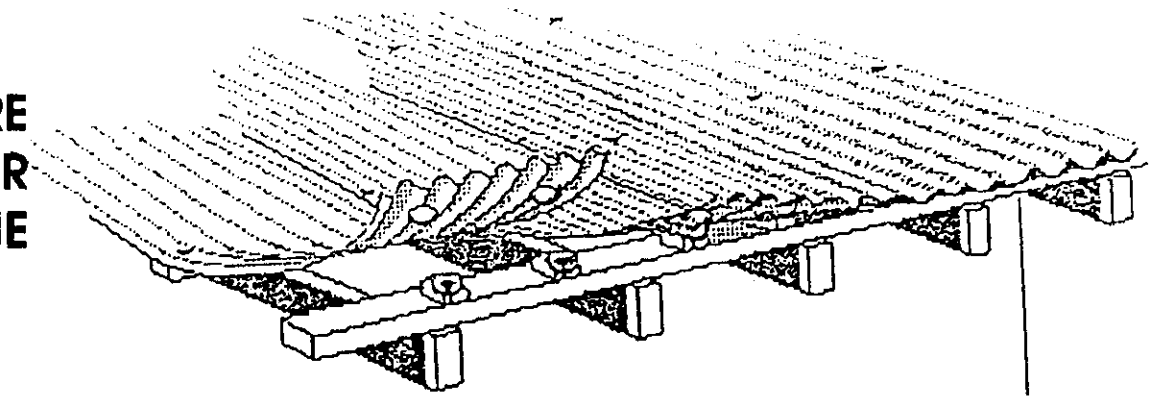
CORRUGATED GALVANIZE SHEETS ARE GAUGED BY NUMBERS. THE HIGHER THE NUMBER THE THINNER THE MATERIAL. EXAMPLE 24 GAUGE GALVANIZE IS SUPERIOR TO 28 GAUGE.

HOW DOES ROOF SHEETING FAIL IN HURRICANES?

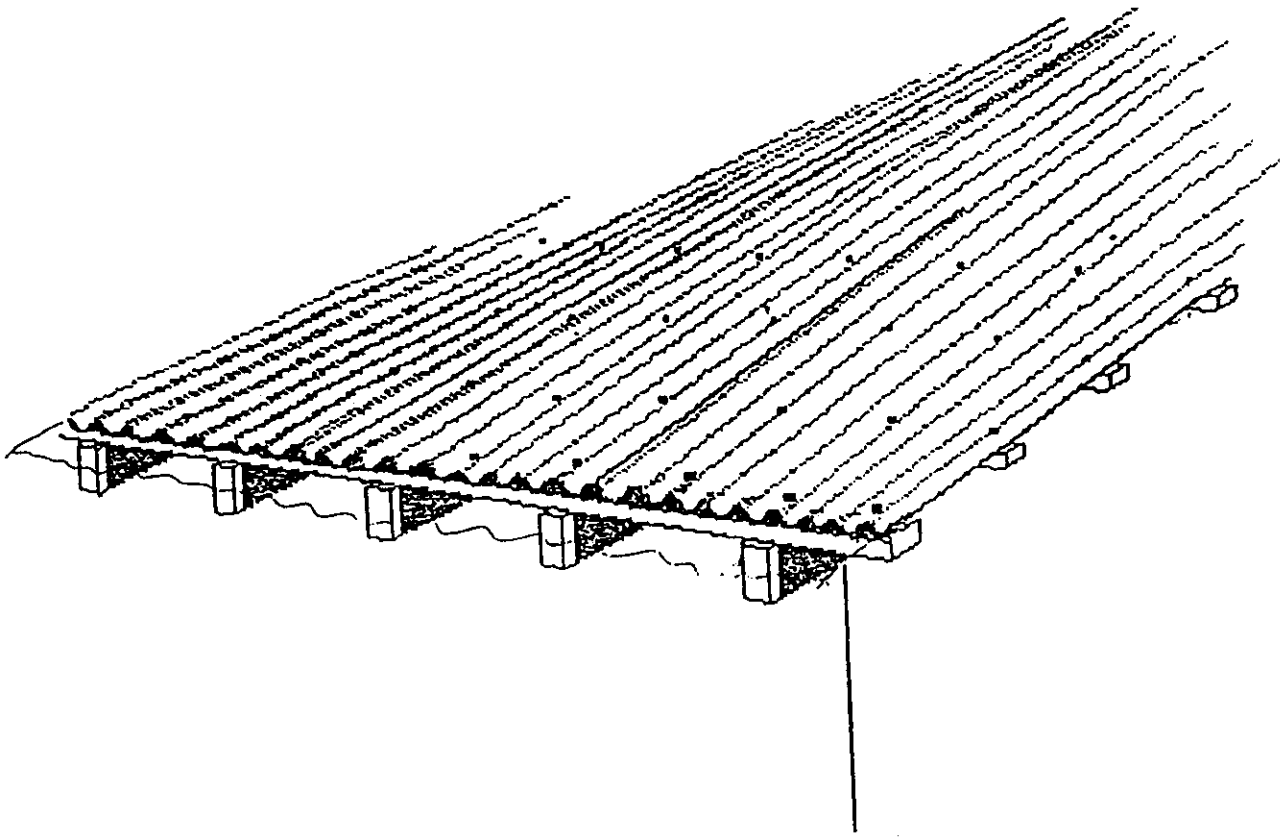


FAILURE IN ROOFS

IF THE SHEETING IS TOO THIN OR THERE ARE TOO FEW FITTINGS, THE NAILS OR SCREWS MAY TEAR THROUGH THE SHEET.



To prevent this type of failure use more fixings for thinner sheetings.

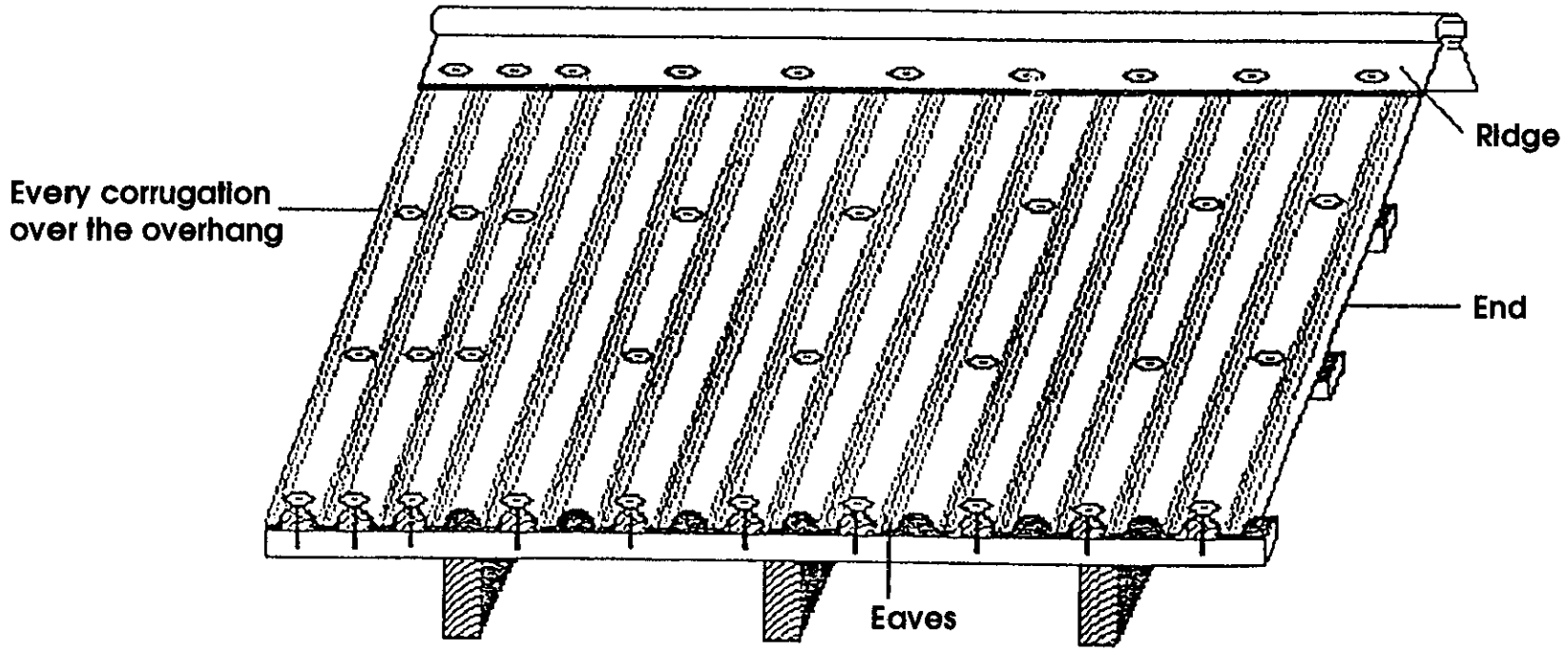


Use fittings with a broad washer or dome head (zinc nail).
To use more fixings for each sheet, put in the laths at closer centres and nail closer together.

ROOFING MATERIALS GALVANIZED SHEETS

IF GALVANIZED SHEETS ARE USED 24 GAUGE IS RECOMMENDED

IF YOU MUST USE 26 GAUGE WHICH IS THINNER, THIS IS HOW TO HOLD YOUR SHEETING TO THE ROOF STRUCTURE.

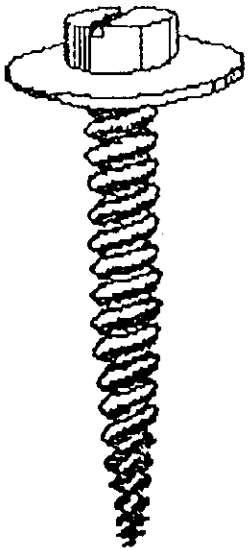


At ridges, eaves and overhangs - fixings every <u>two</u> (2) corrugation.

All other locations, fixings every <u>three</u> (3) corrugation. Maximum spacing.

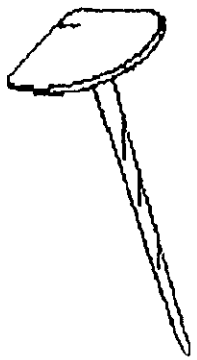
FIXINGS FOR SHEETINGS

SCREWS



- USE PROPER DRIVE SCREWS FOR CORRUGATED GALVANIZED ROOF SHEETS.
- BE SURE THAT THE SCREWS GO INTO THE PURLINGS AT LEAST TWO (2) INCHES.
- USE LARGE WASHERS UNDER THE SCREW HEADS TO PREVENT THE ROOF SHEETS FROM TEARING WHEN PULLED UPWARD BY HIGH WINDS.
- REMEMBER TO USE SUFFICIENT SCREWS SO THAT THE HEADS WILL NOT TEAR THROUGH.

NAILS



- NAILS DO NOT HOLD AS WELL AS SCREWS.
- NAILS ARE CHEAPER
- USE NAILS WITH WIDE HEADS AND LONG ENOUGH TO BEND OVER BELOW THE LATH.
- GALVANIZED COATED NAILS ARE BETTER THAN ORDINARY WIRE NAILS.

LATHS SPACING AND FIXING

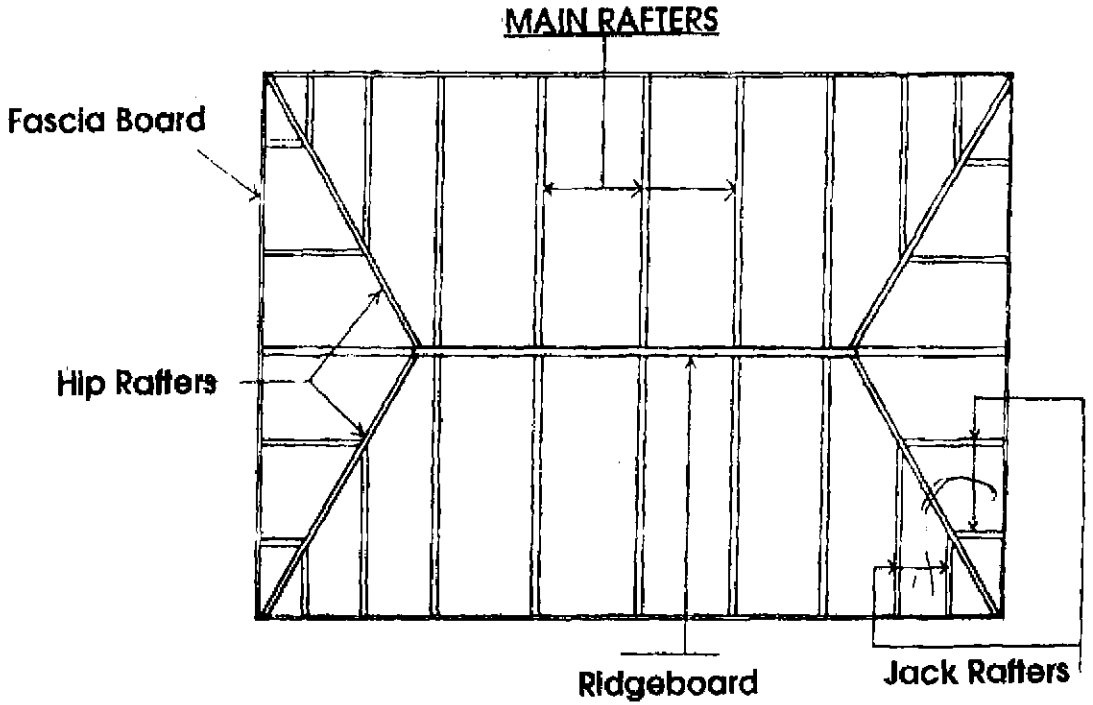
- SPACING FOR LATHS AND NUMBER OF FIXINGS WILL VARY WITH THE GAUGE OF SHEETING USED.
- SCREWS HOLD BETTER THAN NAILS SO FEWER SCREWS CAN BE USED. BUT THE SHEETING MUST BE THICK OR THEY WILL TEAR THROUGH.
- LATHS SHOULD BE PLACED CLOSER TOGETHER FOR THIN SHEETS TO PROVIDE SPACE FOR EXTRA FIXINGS.
- A GUIDE TO THE NUMBER OF FIXINGS AND SPACINGS OF LATHS IS SHOWN BELOW.

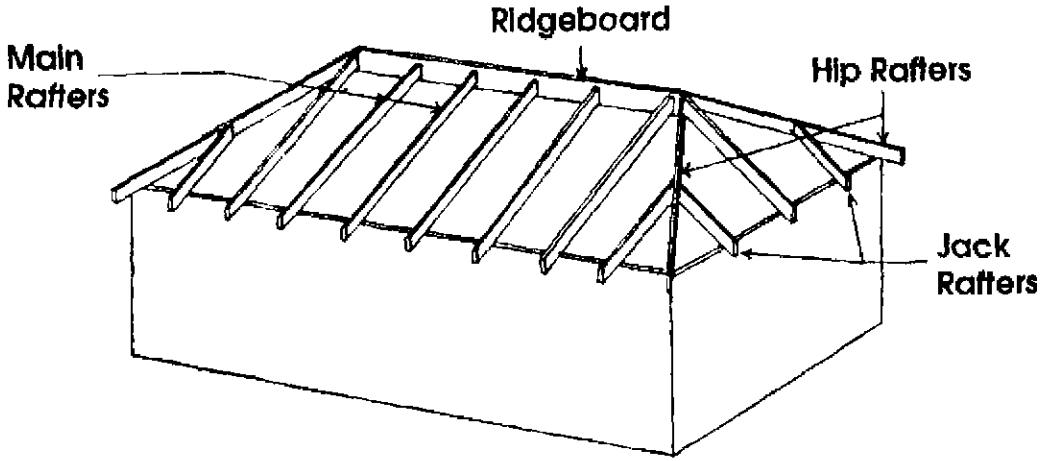
Gauge of Sheeting	Spacing of Laths
26	18 ins - 2 ft.
25	2 ft. - 2 ft. 6 ins.
24	2 ft. for nails 3 ft. for screws

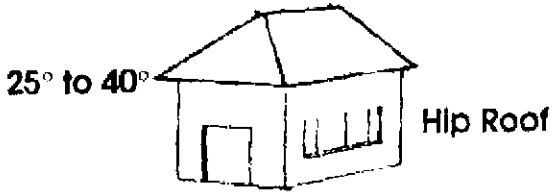
THE ROOF

HIPPED ROOF

This is the strongest type with all sides of the roof sloped. There are no gable ends in this roof. Instead, rafters come across diagonally from the corner and meet the ridge board a short distance from the ends of the house. These are the hip rafters.
Other shorter rafters go from the wall plate to the hip rafter and are called jack rafters.
After the ridge is firmly in position, the rafters are attached to fit neatly onto the wall plate.







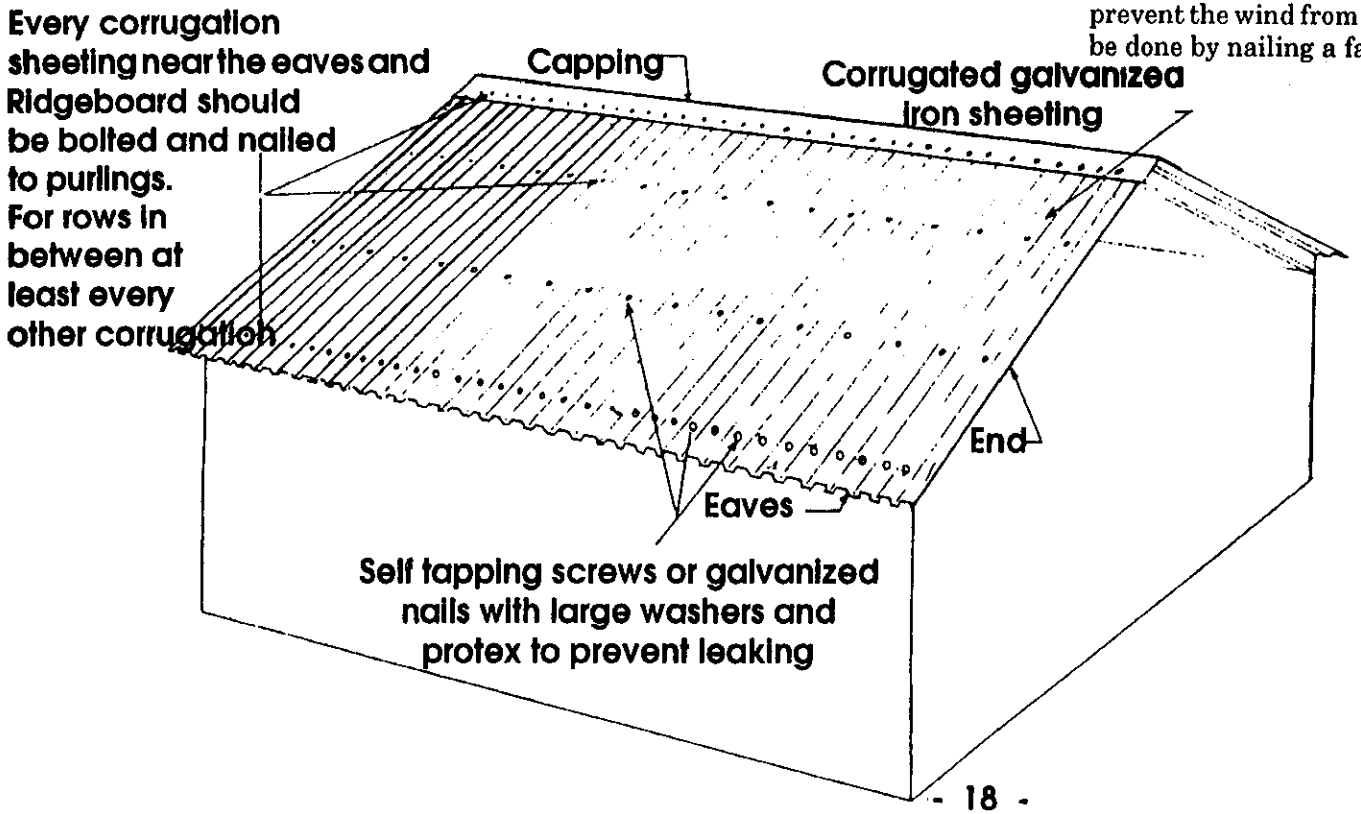
Experience and experiment have shown that the hip roof with the pitch in 25° to 40° range has the best record of wind resistance.

ROOF CLADDING

In addition to the roof structure being fixed to the supporting wall, the cladding must be able to resist and transfer the wind loads to the purlins. Purlins are therefore important structural members of the roof and flat boards should not be used for this purpose. Purlins should be either 2" x 3" or 1" x 4" at no more than 2' 0" spacing. Purlins should be fixed to each rafter passed over using hurricane straps or metal cleats.

- Corrugated galvanized steel sheeting is the most commonly used form of cladding in the Eastern Caribbean. Sheeting which is too thin and with inadequate numbers of fixings is extremely vulnerable during hurricanes. The minimum thickness of corrugated steel sheeting should be 6mm
- sheets should be fixed to the purlins using self-tapping screws or galvanized nails with large washer.
- at the eaves and ridge as well as the gable ends, the fittings should be two corrugations apart, and for the rest of the roof, no more than three corrugations apart.
- the corrugated sheeting should be properly overlapped (at least 2 1/2 corrugation) to prevent water from blowing under the seam.
- roof capping should be made from materials as strong as the sheeting itself, it should be bolted or screwed down to the purlin on either side of ridge or ridgeboard or hip.
- spaces between the sheeting and the wall plate should be closed up to prevent the wind from getting under the sheeting and lifting it. This can be done by nailing a fascia board to the wall plate and rafters.

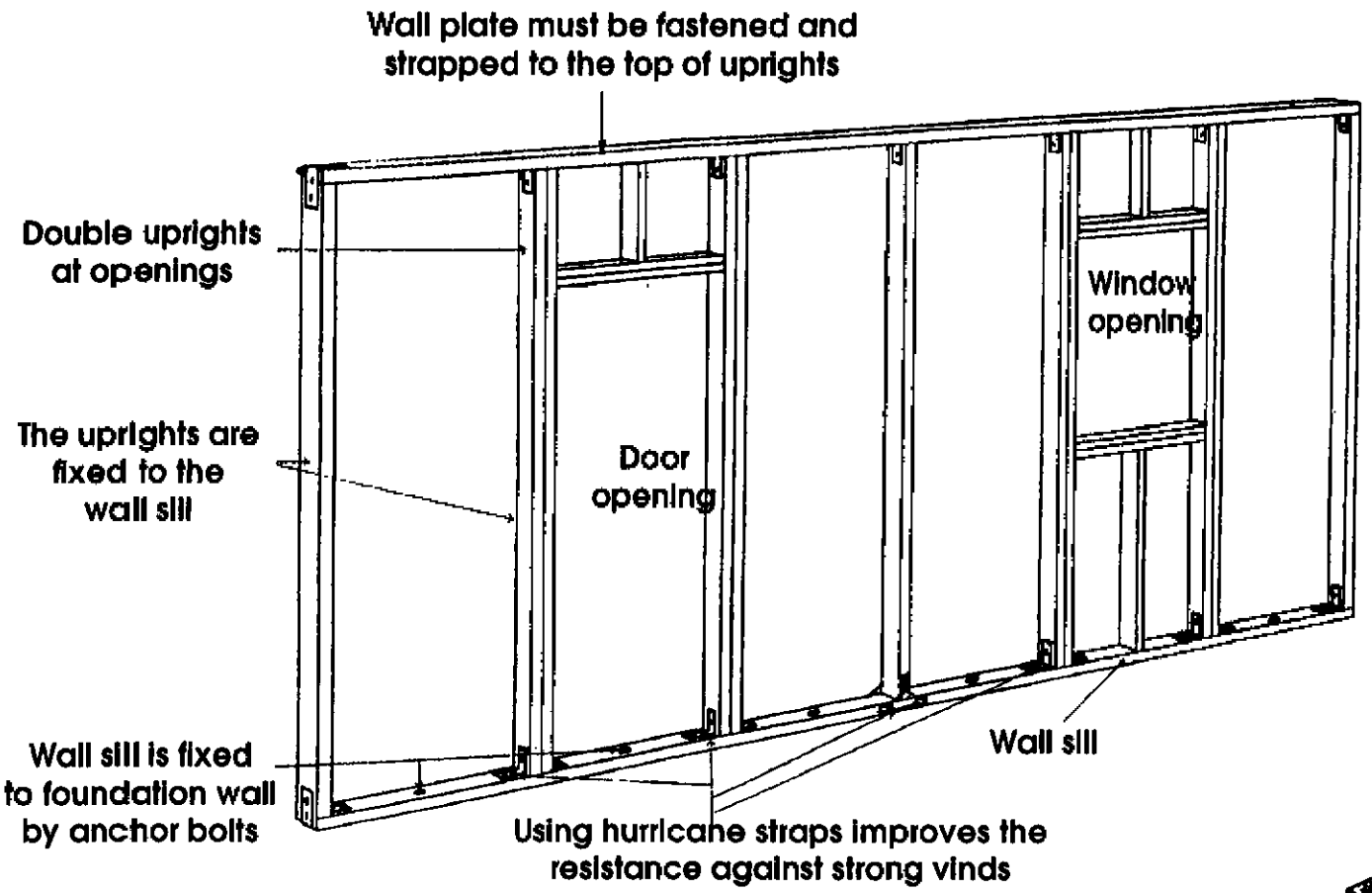
CONNECTION OF SHEETING & CAPPING

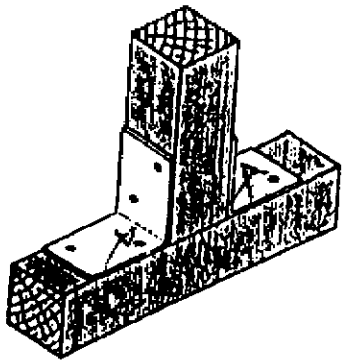


WOODEN WALLS

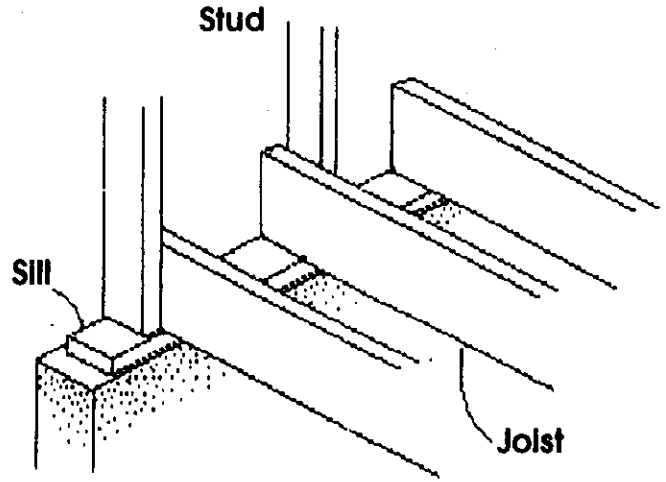
The uprights (or posts) are fixed to the wall cill which is bolted to the foundation wall.
Using metal straps with nails improves the hurricane resistance of timber houses.

WOODEN WALL

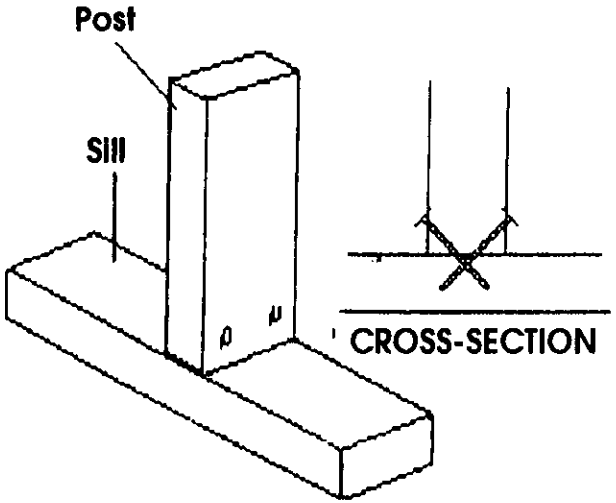




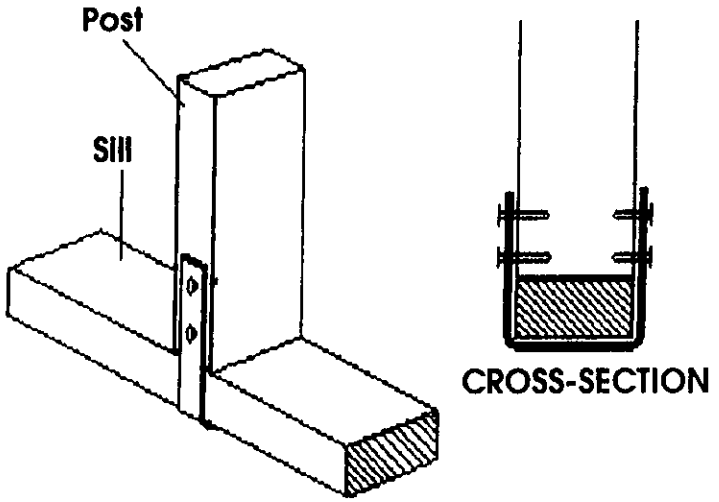
THE WALLS MUST BE SECURELY TIED TO THE FOUNDATION TO PREVENT THE WIND FORCES LIFTING UP THE ENTIRE BUILDING OR BLOWING IT OVER.



CONNECTION FOR TIMBER WALLS



TOENAIL CONNECTION



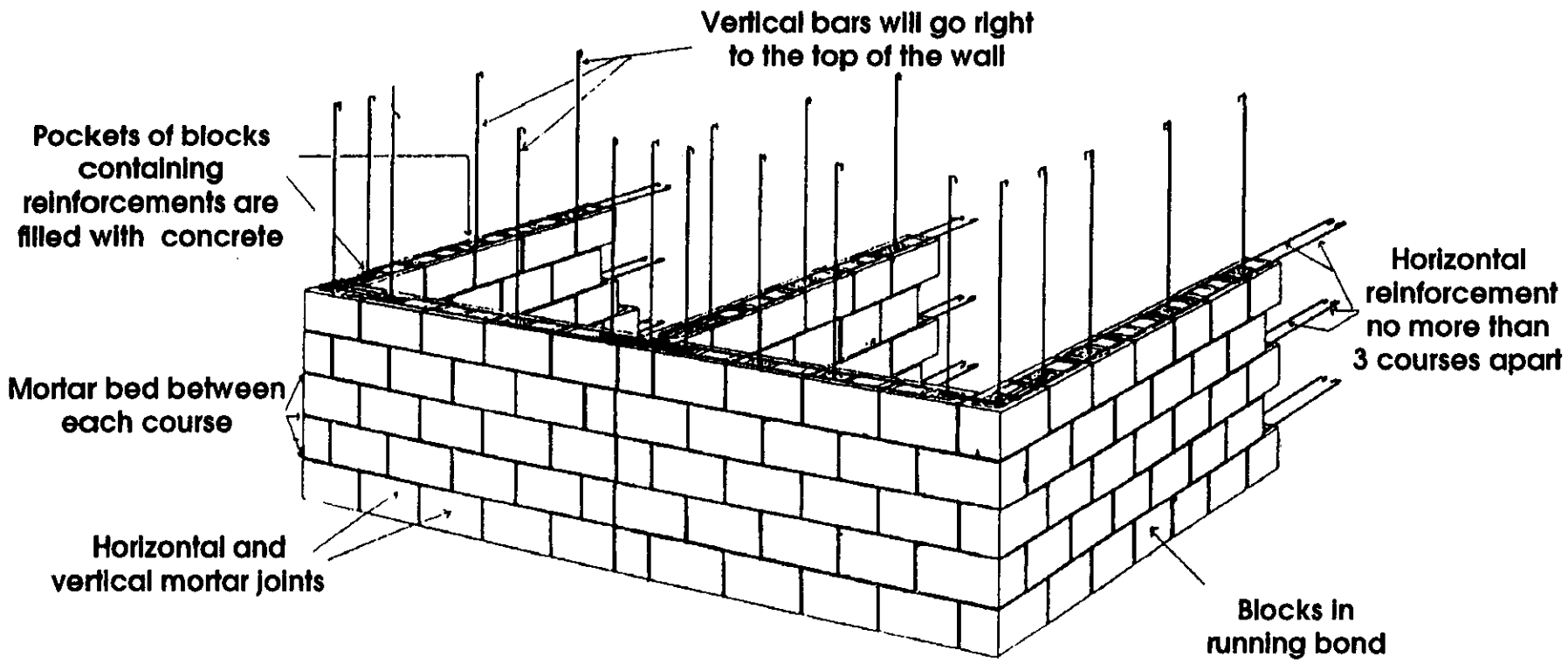
CONNECTION WITH HURRICANE STRAPS

WALLS

Concrete Block Walls

- starter bars coming out of the foundation will tie the wall to the foundation.
- lay blocks so that those starter bars come out through block pockets. For earthquakes the recommended minimum vertical reinforcement is 3/8" diameter bars at 32" centres, this will provide adequate resistance to hurricanes. As more courses are laid you must add more lengths of steel to overlap for at least 12" with starter bars.
- These lengths of steel will go right to the top of the walls.
- pockets of block containing reinforcement are to be filled with concrete
- as each course of blocks is laid, it must be set into a 1:3 mortar bed placed on the last course, mortar is also required on the sides of the blocks to form the vertical joints. Mortar joints should be 1/2" to 5/8" wide.
- galvanized horizontal reinfrocement, Dar-O-Wal or Brickforce, should be laid after every third course. (Two 1/4" diameter bars are often used, but they are likely to rust in the thin mortar joints).
- horizontal reinforcement increases the resistance of the wall to hurricane force winds (and to earthquakes).
- vertical bars are required at all junctions and window and door openings.
- blockwalls should be constructed in running bond rather than stacked bond.

CONCRETE BLOCK WALL



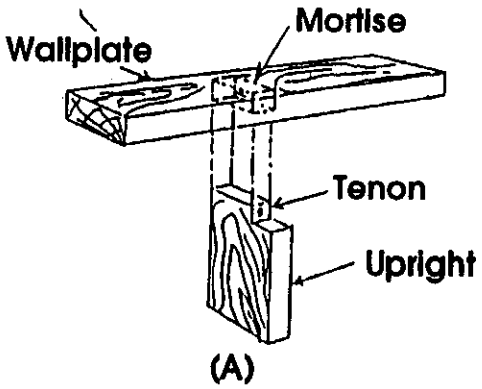
MAKE THE RIGHT CONNECTIONS

TIMBER WALLS

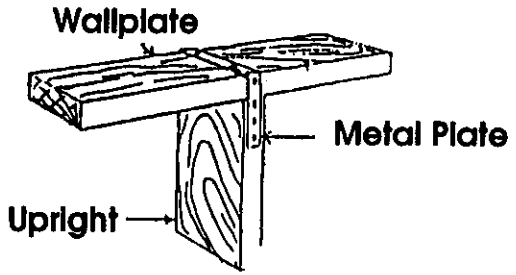
In timber houses the rafters or trusses are connected to a wall plate which is supported by the vertical posts.

Two connections need to be considered.

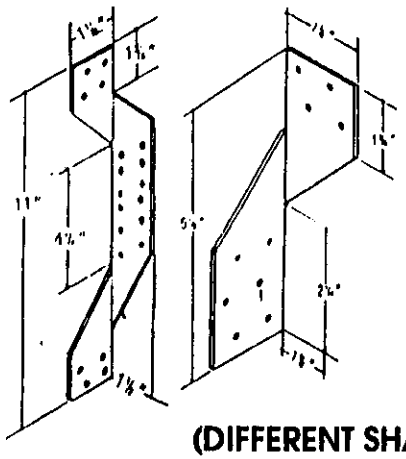
1. The first is the connection between the plate and the uprights which, should be made using metal straps. The conventional solution is a mortise and tenon joint (Figure A) using glue and sometimes dowel pins. Suction forces on the roof may cause this joint to fail.
2. The second connection is that between the rafter and the plate. The standard solution is to nail or spike the rafter to the wall plate. Under high suction forces these nails or spikes may pull out. It is strongly recommended that hurricane straps (or metal connectors) be used for these connections. The connectors may either be purchased off the shelf or made up on site using 20 gauge galvanized sheet metal.

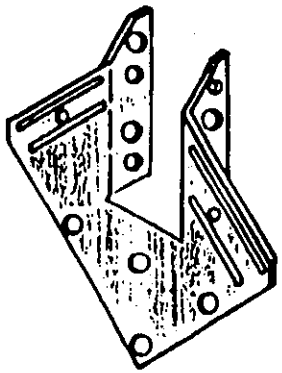


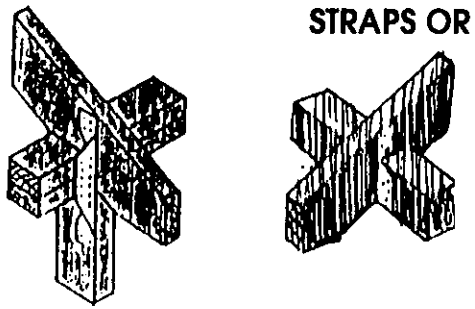
(A)



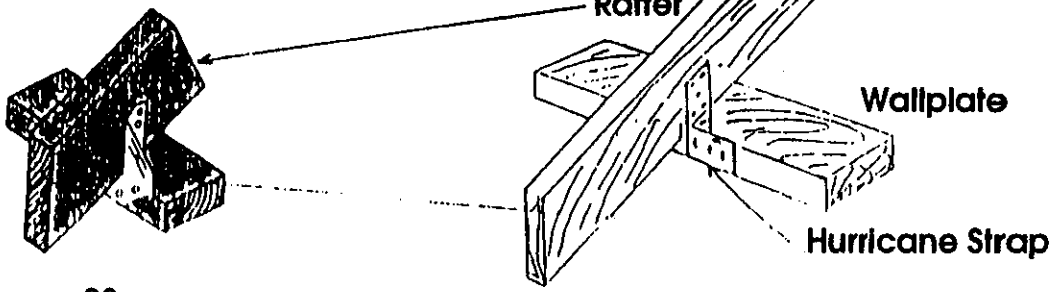
(B)



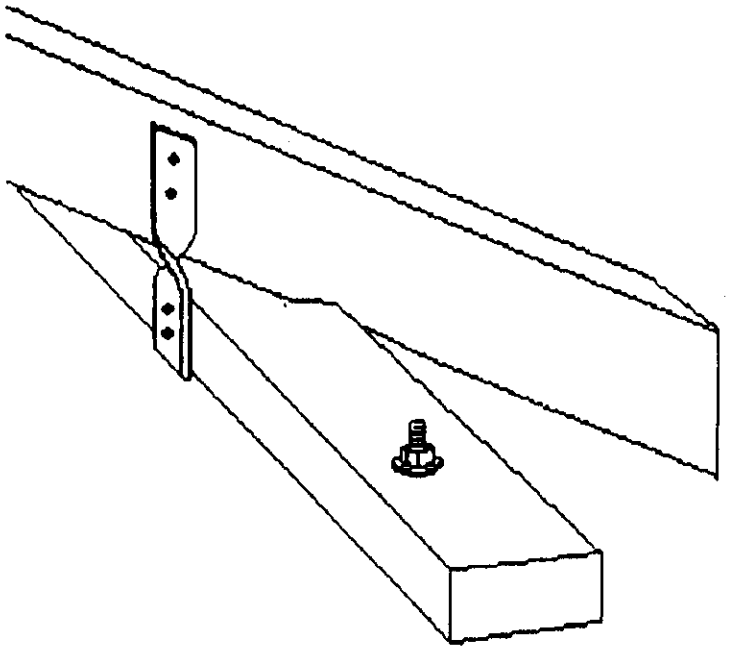




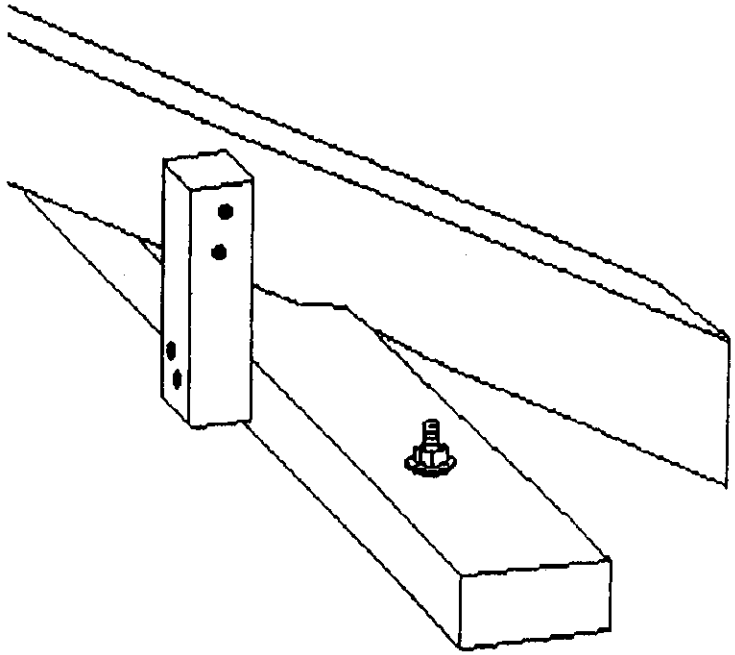
(DIFFERENT SHAPES OF HURRICANE STRAPS OR METAL CONNECTORS)



RAFTERS WILL LIFT OFF WALL PLATES IN HIGH WINDS. THEY MUST BE HELD DOWN BY MORE THAN NAILS. STRAPS CAN BE INSTALLED IN EXISTING ROOFS TO STRENGTHEN THEM.

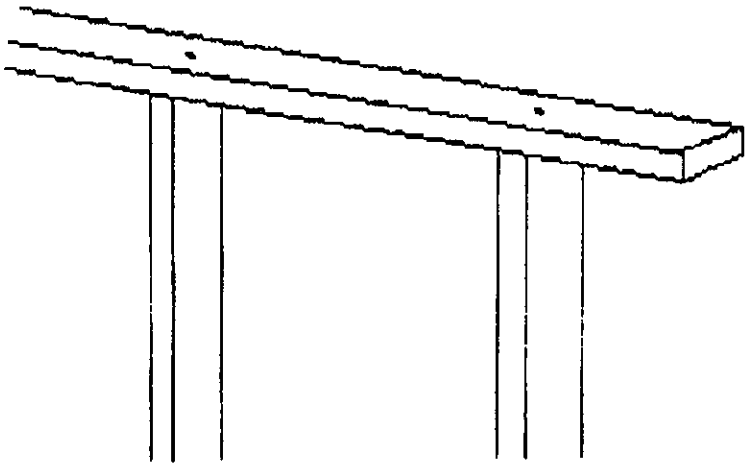


Twisted straps nailed through rafter with 2 1/2 inch nails. Bend over the ends of nails. Be careful when selecting hurricane straps, ensure that they can be properly affixed so that when nailed, the nail is not too near the edge.

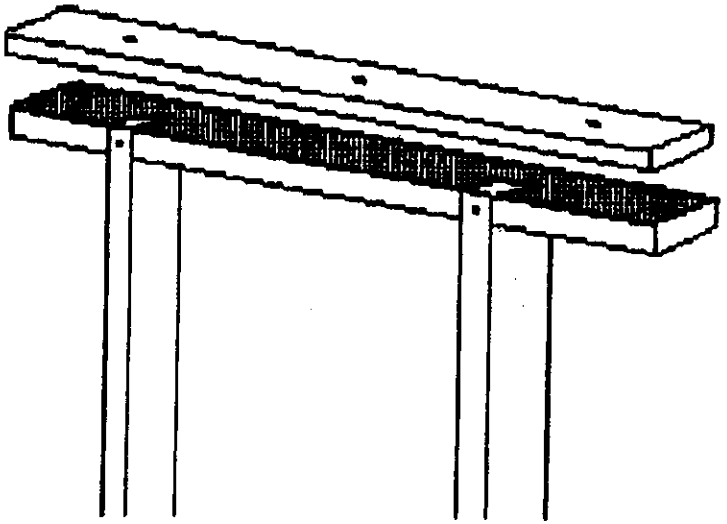


Timber connector may be used as an alternative. Make sure that the wood is strong.

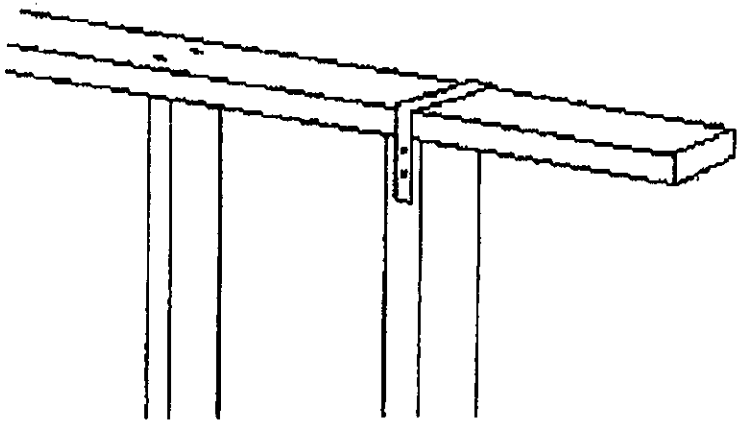
WALL PLATES FOR WOODEN BUILDINGS ARE CRITICAL BECAUSE THEY PROVIDE STIFFNESS FOR THE BUILDING AND ALSO SERVE TO HOLD THE ROOF DOWN.



• They are often insecurely held down by nails into the end grain of posts.

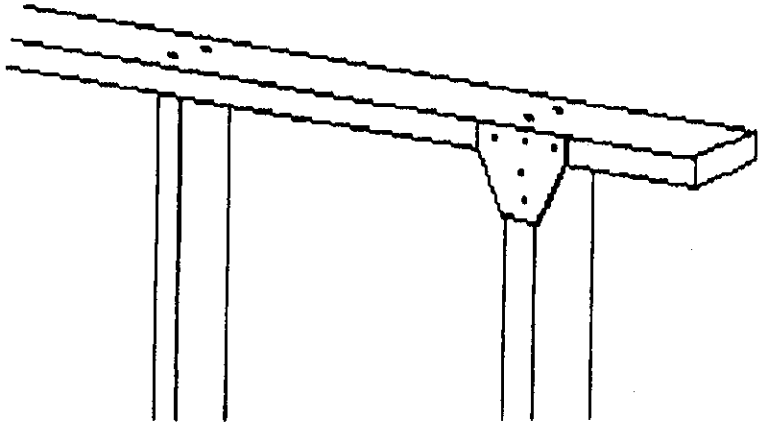


• If a double plate is used, notch and nail the lower one and secure the top one well.



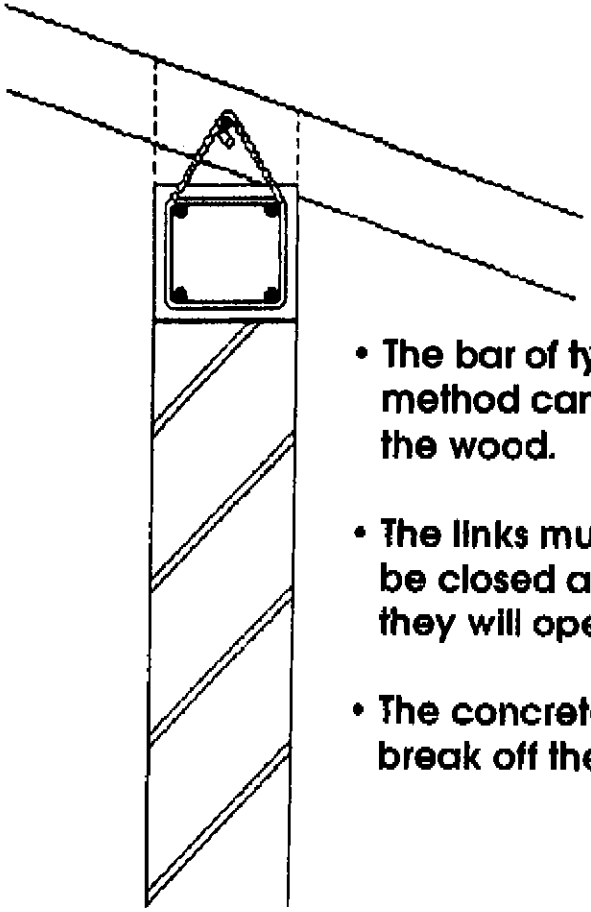
• To strengthen use a strap over the top.

OR



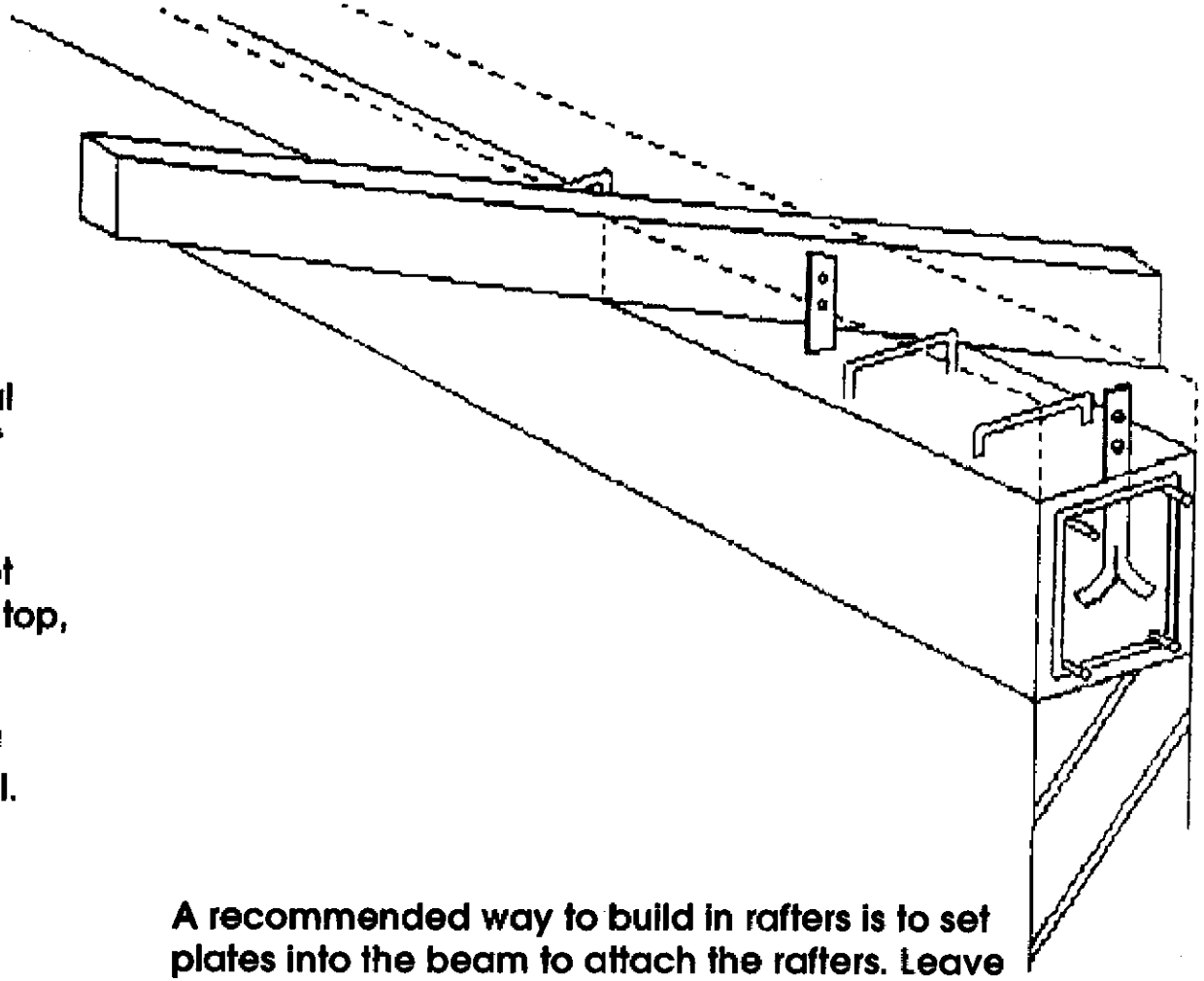
• Use a gusset of zinc or plywood.

RAFTERS MAY BE BUILT INTO THE BELT BEAM AT THE TOP OF THE WALL. HOWEVER THIS PRACTICE IS DISCOURAGED BECAUSE OF FAILURES OBSERVED AFTER RECENT HURRICANES.



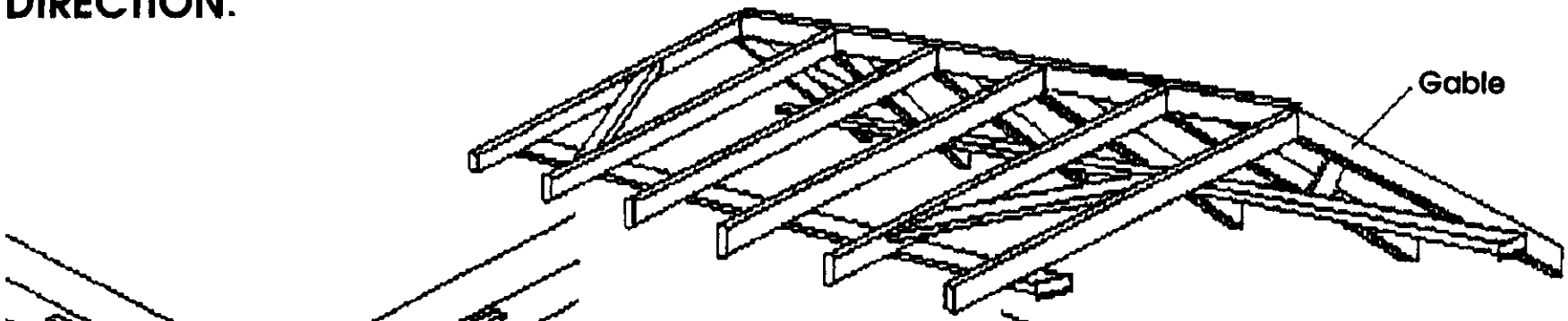
- The bar of typical method can split the wood.
- The links must not be closed at the top, they will open.
- The concrete will break off the wall.

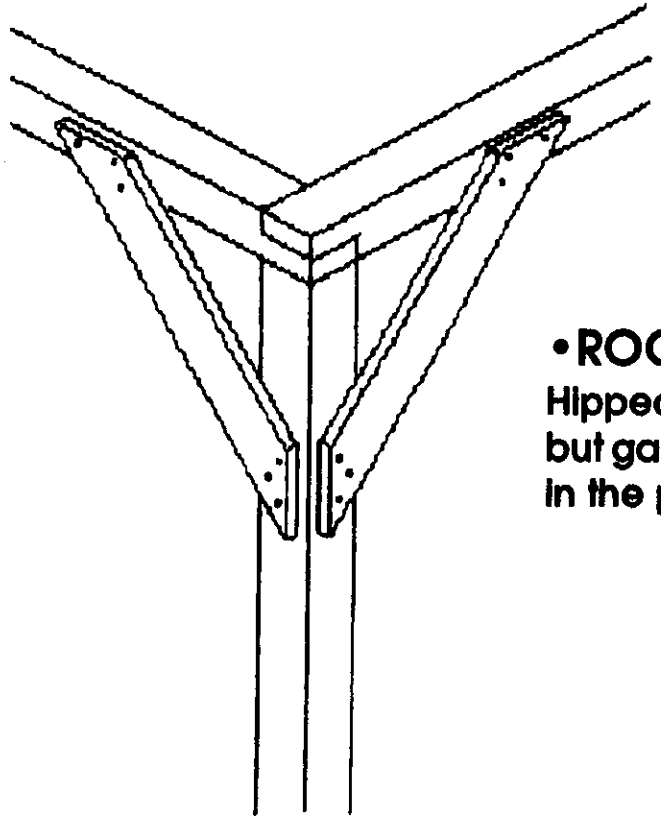
FAILURE MODES OF TYPICAL METHOD



A recommended way to build in rafters is to set plates into the beam to attach the rafters. Leave some links showing after securing the rafters to the plates, concrete is cast between them up to sarking level.

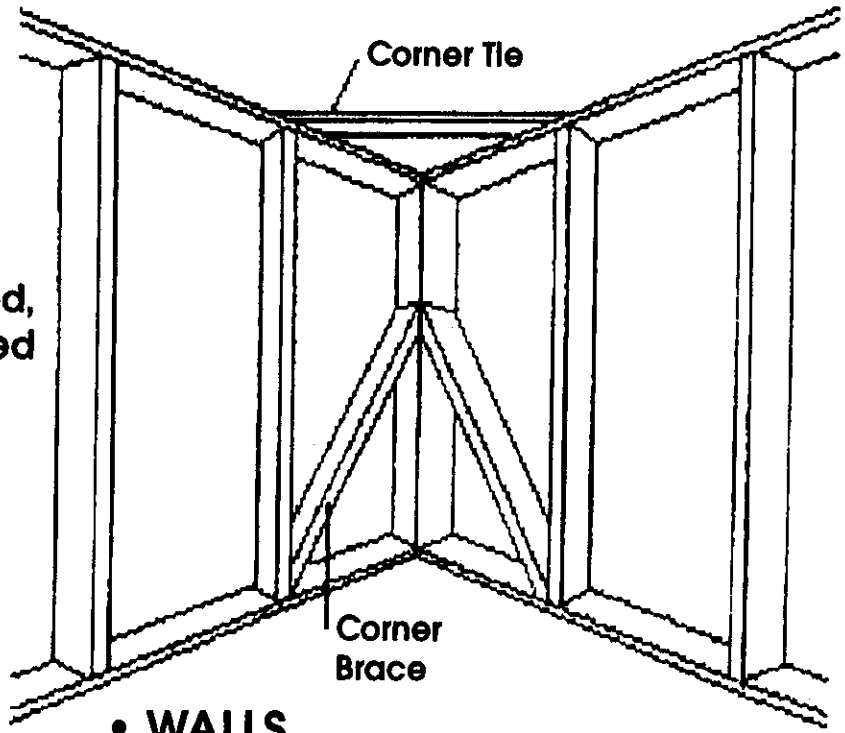
IN TIMBER BUILDINGS, POST FOUNDATION, ROOFS AND WALLS MUST BE BRACED IN EACH DIRECTION.





• ROOFS

Hipped roofs are naturally braced, but gable roofs should be braced in the plane of the roof.



• POST FOUNDATIONS

Where posts are more than 3ft., brace both ways.

• WALLS

Walls should be braced across corners at plate level and at both corners of each wall.

MAINTENANCE

1. **Experience and statistics show that the lack of maintenance is a significant contributing factor in damage to houses by hurricanes.**

2. **Regular maintenance is necessary in order to ensure that a structure continues to be hurricane resistant.**

3. **Check the entire house regularly inside and outside - to see if anything needs repairing or replacing, and fix it immediately.**

4. **The most important areas for regular checks are:**

   (a) **Roof cladding for damage and fixings for missing screws or bolts.**

   (b) **Roof structure; rafters and purlins for soundness.**

   (c) **Joints and connections in timber and masonry construction for structural integrity and durability.**

   (d) **Concrete blocks and slabs for cracks.**

   (e) **For houses on wooden supports, check supports for rot, especially those below ground level.**

   (f) **Check for termites and treat when evident. Obtain specialist advise for this problem.**

Material in this Booklet compiled by:-
Severin McKenzie (Architect)
Lennard Andre (Architect)

CARIBBEAN DISASTER MITIGATION PROJECT

The Caribbean Disaster Mitigation Project (CDMP) is a coordinated effort to promote the adoption of natural disaster mitigation and preparedness practices by both the public and private sectors in the Caribbean region through a series of activities carried out over a five-year period. The CDMP is funded by the USAID Office of Foreign Disaster Assistance (OFDA) and implemented by the Organization of American States/Unit of Sustainable Development and Environment (OAS/USDE) for the USAID Caribbean Regional Program (USAID/CRP)

The CDMP provides a framework for collaboration with the Caribbean region to establish sustainable public and private sector mechanisms for natural disaster mitigation that will measurably lessen loss of life, reduce the potential for physical and economic damage, and shorten the disaster recovery period over the long term Project activities vary according to location, contents and implementation strategy, but all contribute to attainment of the overall CDMP goal: a more disaster-resistant environment for the people who live, work and invest in this hazard-prone region.

Project activities include: 1) natural hazard risk audits for electrical utilities and other infrastructure systems and key lifeline facilities, 2) hazard mapping to support improved planning and location of physical development; 3) promotion of loss reduction incentives and hazard mitigation in the property insurance industry; 4) assisting countries to adopt improved building standards and practices and training of builders, architects and artisans in their use, 5) stimulating community-based disaster preparedness and mitigation efforts with support of the private sector, and, 6) post disaster mitigation planning and program design.

The CDMP will build on past and ongoing regional initiatives in disaster preparedness and mitigation, and will promote technology transfer and institutional capacity building through direct involvement of professional associations, bankers, builders, insurance companies and reinsurers, NGOs, PVOs, community groups and government organizations in project activities

For further information please contact:

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COOPERATIVE HOUSING FOUNDATION

CHF is a non-profit international development organization helping low-moderate income families around the world improe their living conditions, livelihoods and communites. CHF's skills address a wide range of development issues:

HIGHLIGHTS OF CHF'S INTERNATIONAL PROGRAMS:

GAZA - CHF has established a home improvement loan program disbursing over $4 million eithin one year to more than 900 families. The Cairo-Amman and Arav Banks are noew contributing to the program

GUATEMALA - In thte war-torn Ixcan area CHF is working with Mayan leaders on community development projects ranging from foot bridges to schools and from communti health clinics to agroforestry and village banking

HAITI - CHF designed and managed a series of sanitation and infrastructure projects creating jobs for 12,000 Haitinan workers and improving health conditions in urban and rural jurisdictions.

MEXICO - A unique partnership with "Maquila" factories provides workers small loans for home upgrades, including water and sanitation. Training local NGOs for expansion and replication of this model is a key part of the program

POLAND - CHF is supporting housing finance alternatives, introducing market-based mortgages, and establishing democratically run cooperatives to provide hundreds of families with new affordable homes.

SNAPSHOT OF CHF'S 1996 ACCOMPLISHMENTS WORKING IN 30 COUNTRIES

New Units: 667	**People Trained:** 9,208
Loans: 3,685 **Totaling:** $5.8 Million	**Women Receiving Direct Assistance:** 17,929
Home Improvements: 6,034	**Employment (in person months):** 44,263
Housing Beneficiaries: 34,523	**NGOs and Co-Ops Assisted:** 562

HOUSING:
Cooperative Housing, Home Improvement Lending, Housing Privatization, New Affordable Housing, Association Management

COMMUNITY IMPROVEMENT:
Community Development, Municiapla Development, Urban Sanitation, Environmental Programs

MICROENTERPRISE:
Home-based Business
Home Asset Lending
Local Construction and Building Matenals
Businesses
Productive Asset Development

NGO STRENGTHENING:
Financial Management
Credit Program Development
Business Plan Development
Membership Outreach and Services
Training
Organizational Development

WOMEN'S DEVELOPMENT:
Home-Based Businesses
Leadership Development
Skills Training
Health Employment and Training