

Dominica Housing Standards

Material prepared by Dominica Physical Planning Division
Produced by UNDP and Engineers Without Borders - USA.

The publication of this booklet forms the Housing Standards for the Country of Dominica.

Alternate housing systems must be submitted to the Dominica Physical Planning Division for approval.

This project was developed with assistance from UNDP and Engineers Without Borders - USA

Much of this booklet was from the publication from 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).



*Empowered lives.
Resilient nations.*

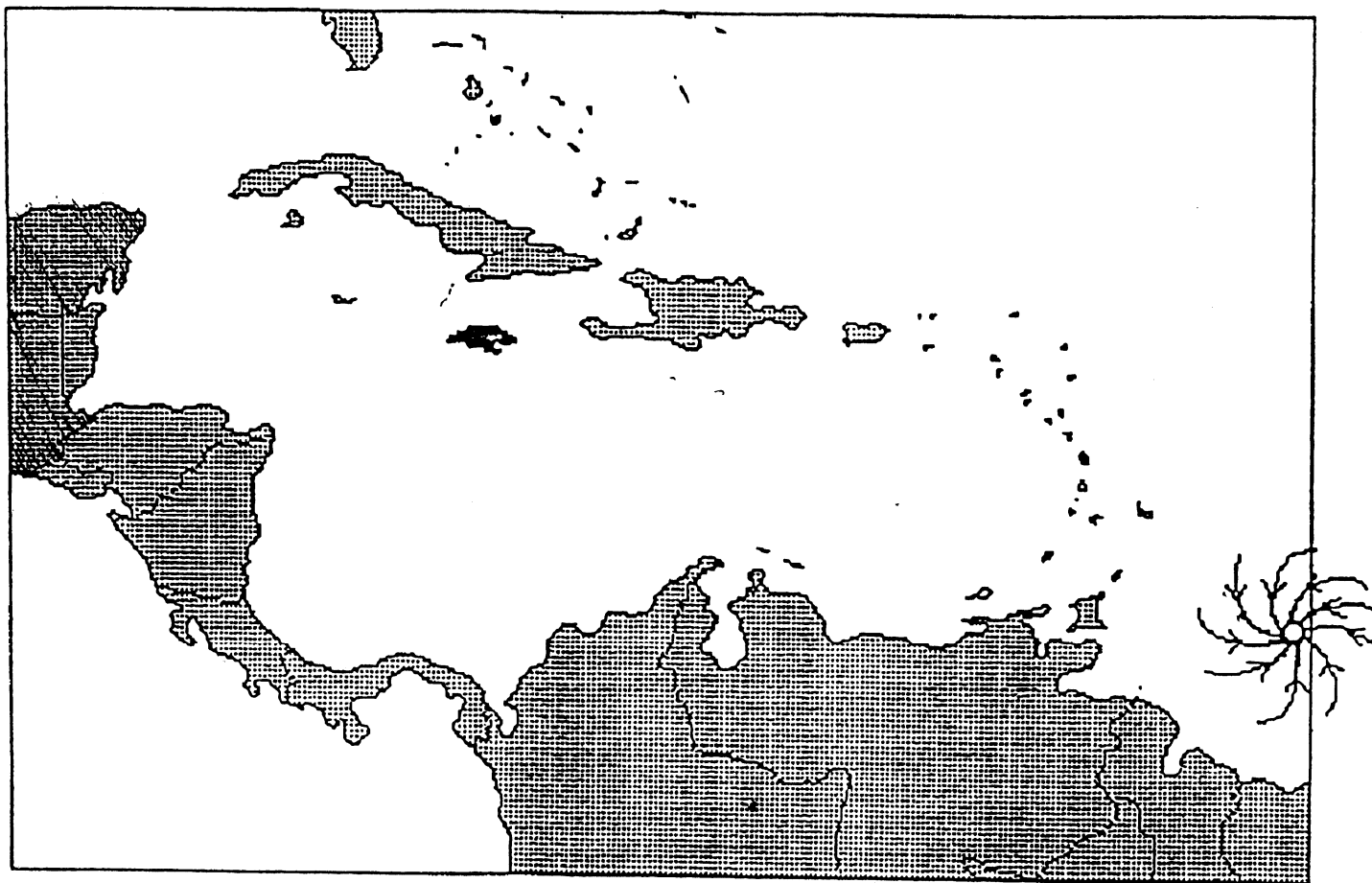


- Roof Sheeting shall be 24 gauge unless supported on 1/2” or thicker plywood, when it can be 26 gauge
- Imported wood shall be Grade 2 or better and shall be pressure treated.
- Hurricane clips are required. Clips shall be rated for “High Wind Construction” and shall be of “High Corrosion Rating”
- Roofing shall be attached by #9 screws at least 2 ½” in length
- Concrete roofs require separate approval by the Physical Planning Division.
- Rafters spanning more than 20’ must be designed by an engineer and submitted to the Physical Planning Division.
- Keep in mind that Dominica is also in a **high seismic risk area** for earthquakes as well as risk from hurricanes and volcanoes.

DOMINICA HOUSING STANDARD

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.

10/26/2017

You may get a lull as the eye passes over.

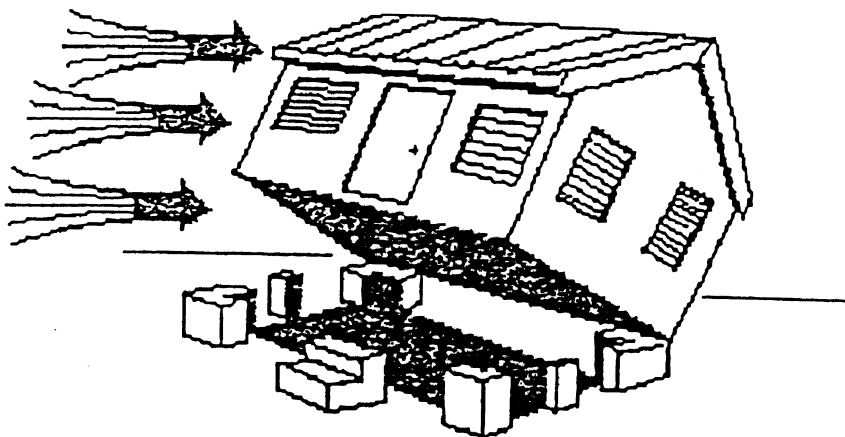
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After the eye passes, the wind will come again from a different direction.

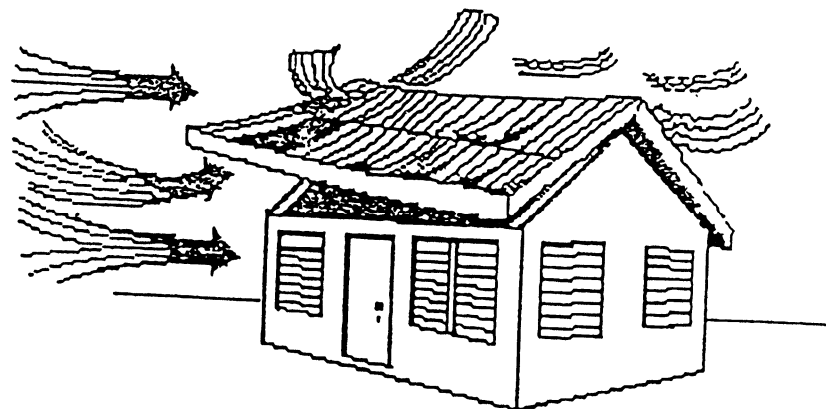
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HURRICANES AFFECT HOUSES BECAUSE OF ENORMOUSLY POWERFUL WINDS.

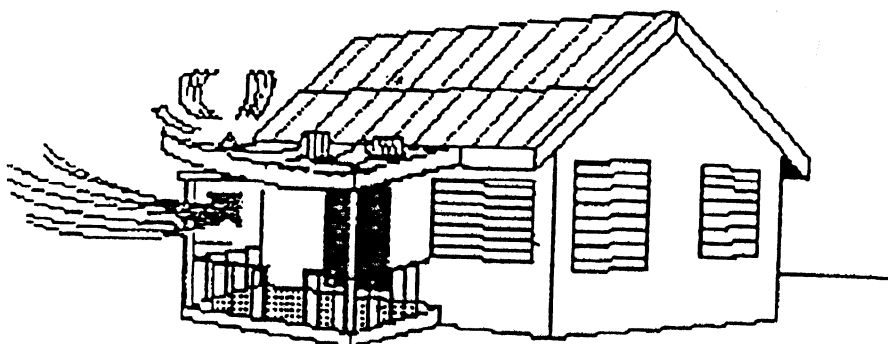
THEY CAN:



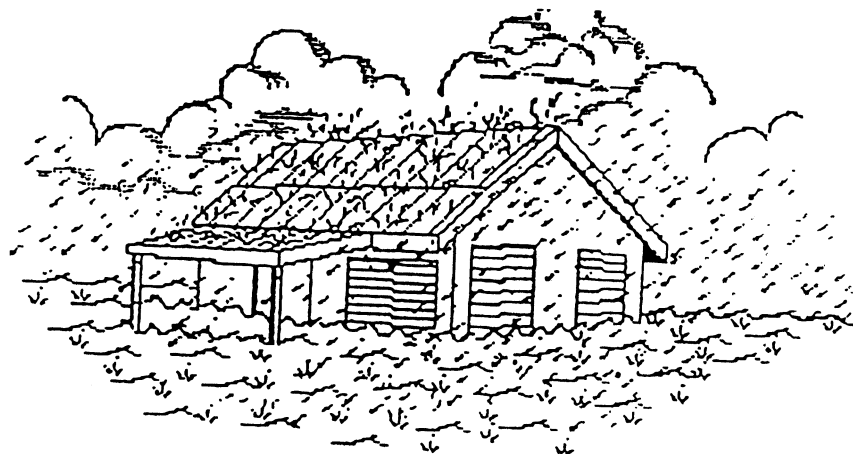
(1) Blow it off its footing



(2) Take off the roof



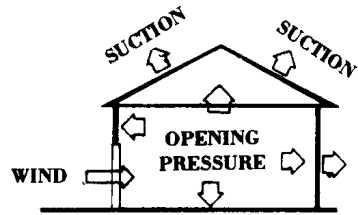
(3) Remove verandah and garage roofs.



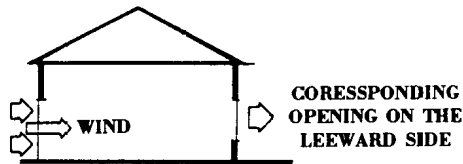
(4) Cause flooding because of heavy rains.

DOMINICA HOUSING STANDARD

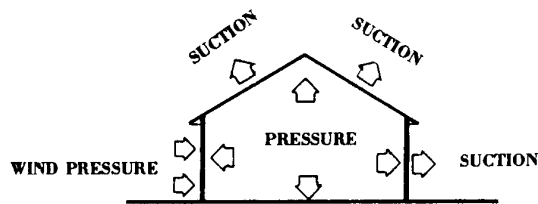
HURRICANES



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.

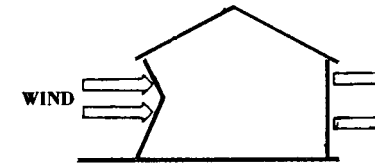


During a hurricane an opening may suddenly occur on the windward side of the house. The internal pressure which builds up as a result may be relieved by providing a corresponding opening on the leeward side.



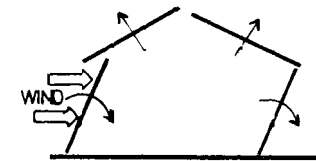
Failure of the Wall: Wind forces on the walls of the house may produce failure. Wind striking a building produces pressure which pushes against the building, on the windward side, and suction which pulls the building on the leeward side and the roof. If no air enters the building, then there is pressure inside which is pushing against the walls and the roof.

10/26/2017



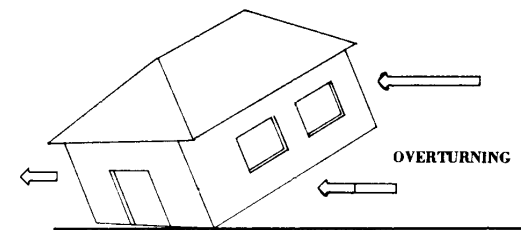
Windward face of the building collapses under pressure of windforce

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.

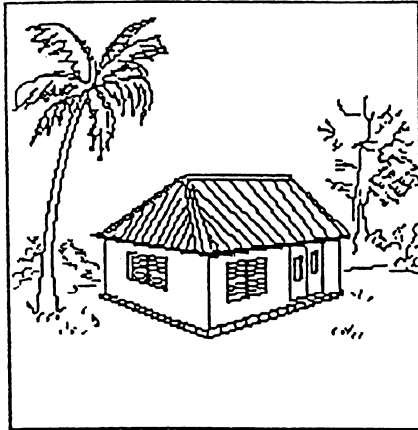


Overturning is another problem for light structures. This occurs when the weight of the house is insufficient to resist the tendency of the house to be blown over.

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

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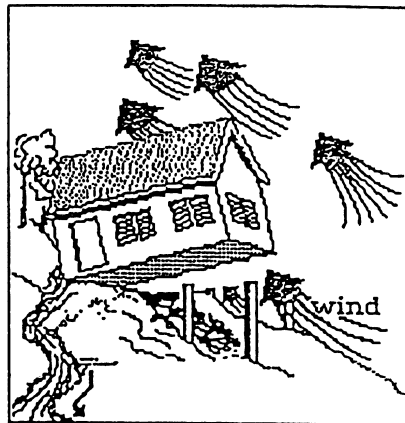
WHEN CHOOSING A SITE FOR YOUR HOUSE, CONSIDER THE FOLLOWING:



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

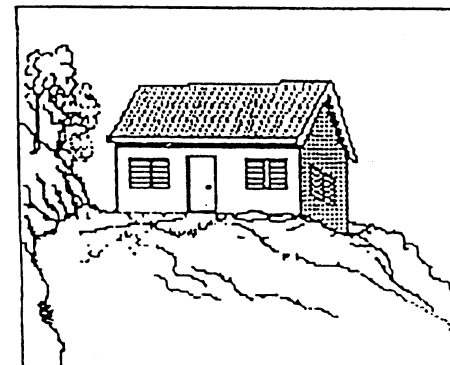


If your lot is on a slope don't place the house like this *unless it is properly anchored*.



The wind and water can dislodge the house.

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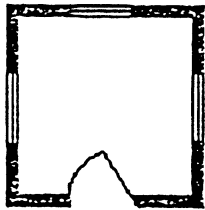
Cut and fill is a common means of leveling a house site. Avoid building on the fill. *Foundation should be on solid ground*. This house is safer, cut into the side of the hill.

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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.

SHAPES OTHER THAN THOSE BELOW SHALL BE SUBMITTED FOR APPROVAL TO PHYSICAL PLANNING DIVISION



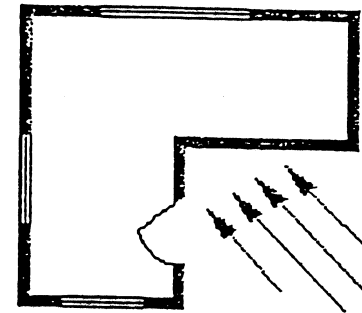
Square (Best)



Rectangle



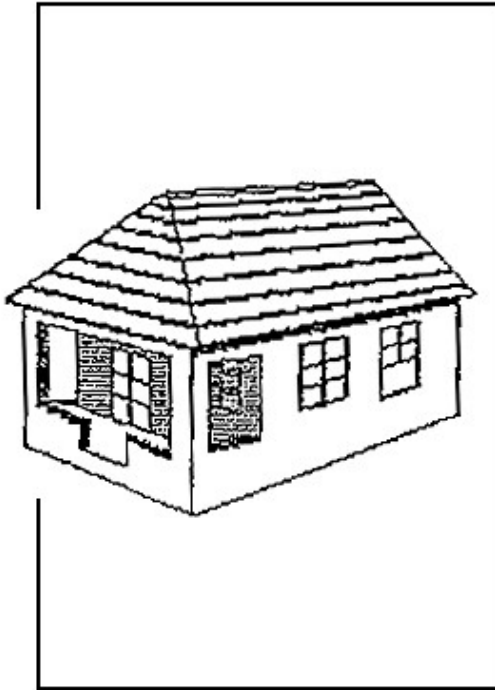
Long Rectangle



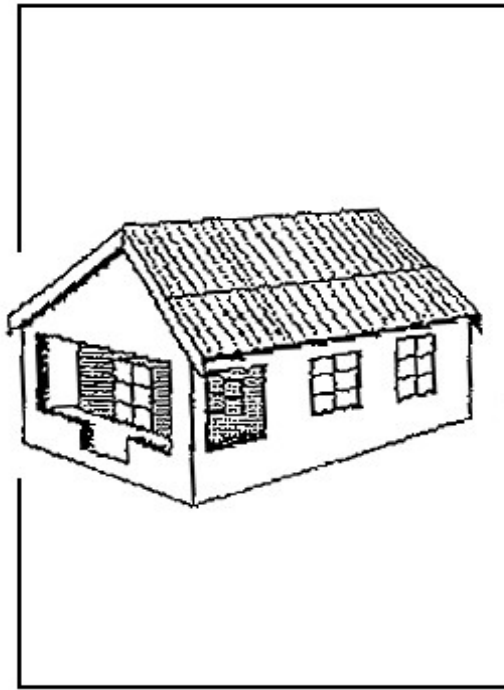
L-Shape

ROOMS FORMED BY STRUCTURAL WALLS SHALL NOT HAVE A LENGTH GREATER THAN 16' OR A LENGTH MORE THAN THREE (3) TIMES THE WIDTH .

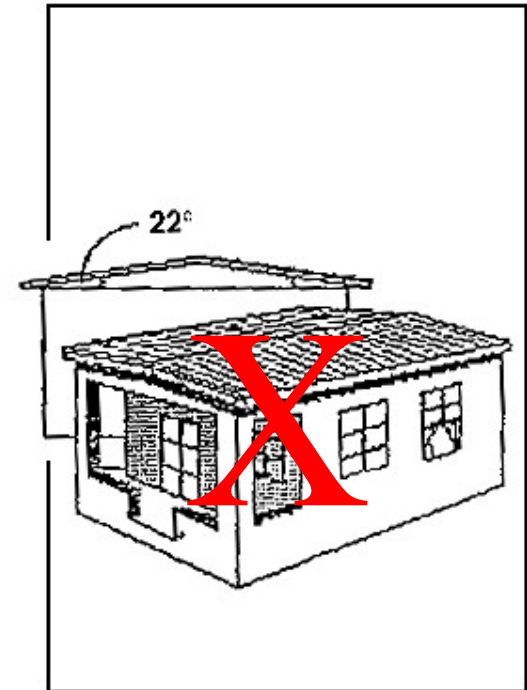
LIGHTWEIGHT FLAT ROOFS ARE EASILY BLOWN OFF IN HIGH WINDS. IN ORDER TO LESSEN THE EFFECT OF THE UPLIFTING FORCES ON THE ROOF, THE ROOF PITCH SHALL NOT BE LESS THAN 22°. HIP ROOFS ARE GOOD, THEY HAVE BEEN FOUND TO BE MORE HURRICANE RESISTANT THAN GABLE ROOFS.



Hip roof



Gable roof



Flat roof

GENERAL DESIGN CONSIDERATIONS

1. Use a hip roof or a high pitched gable roof.
2. Avoid overhanging roofs. If overhangs or canopies are desired, they SHALL be separated from the main roof structures.

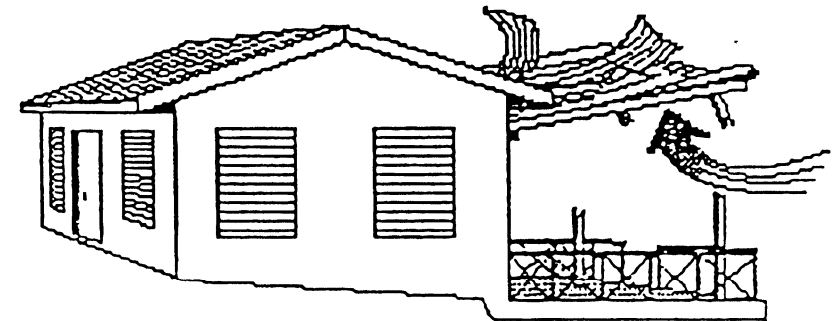
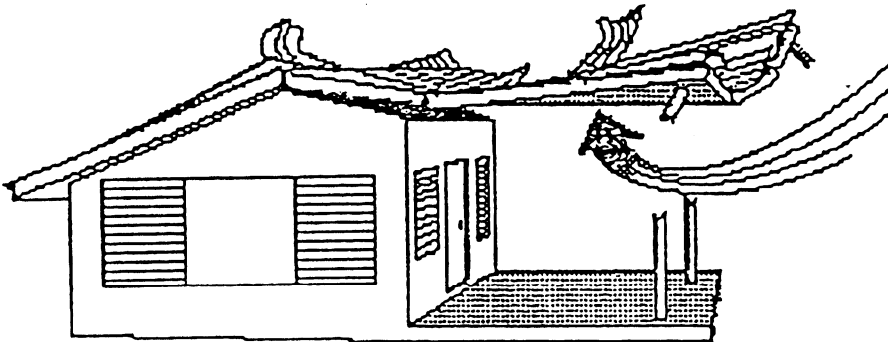
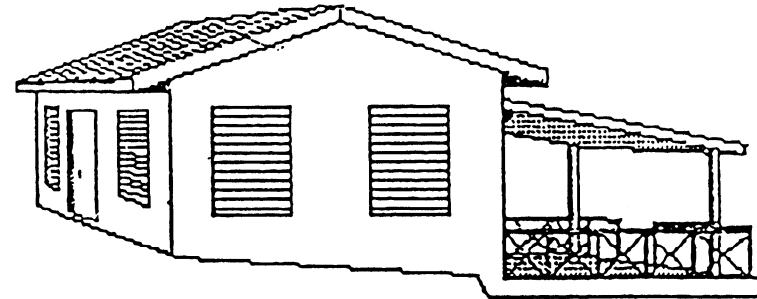
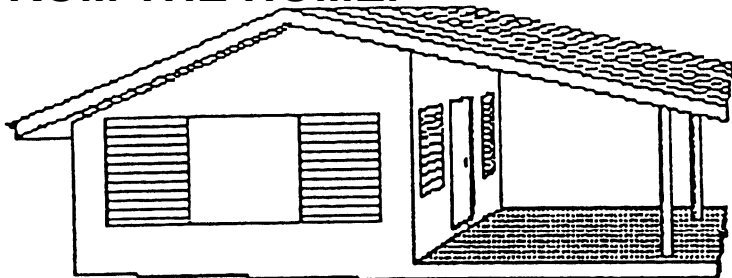
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3. Avoid openings which cannot be securely closed during a hurricane. Where openings are already in existence, hurricane shutters should be provided.

4. Use a shape that forms a square or rectangle with length to width ration no more than 3:1.

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OVERHANGS, PATIOS AND VERANDAHS EXPERIENCE HIGH WIND PRESSURES AND SHOULD BE KEPT SHORT AND SMALL AND SEPERATED FROM THE HOME.



- Overhangs shall 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.

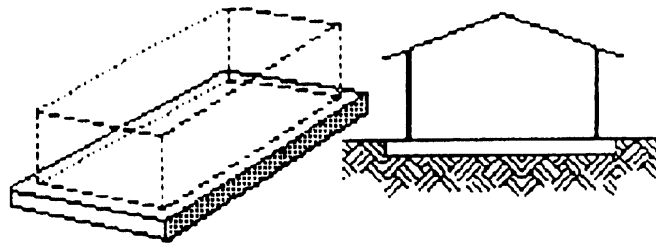
- They may blow off without damaging the rest of the house.

DOMINICA HOUSING STANDARD

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.

The main types of foundation are:

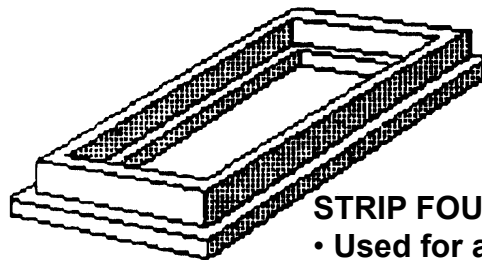
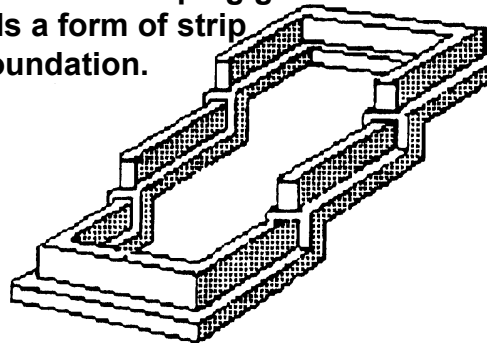


SLAB OR RAFT FOUNDATION

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

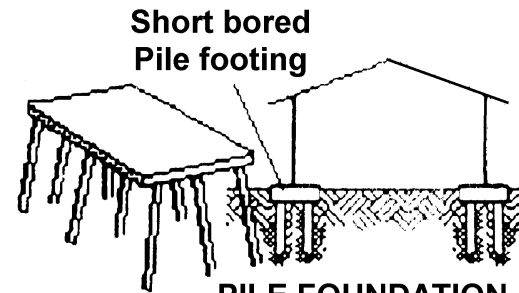
STEPPED FOUNDATION

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



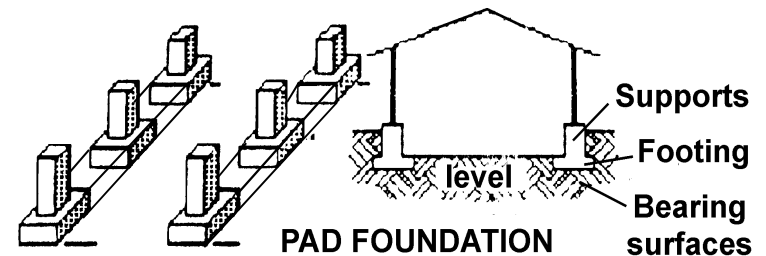
STRIP FOUNDATION

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



PILE FOUNDATION

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



PAD FOUNDATION

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

NOTE: Tie beams between pads are required.

FOUNDATION CONSTRUCTION TECHNIQUES

The functions of the foundations are:

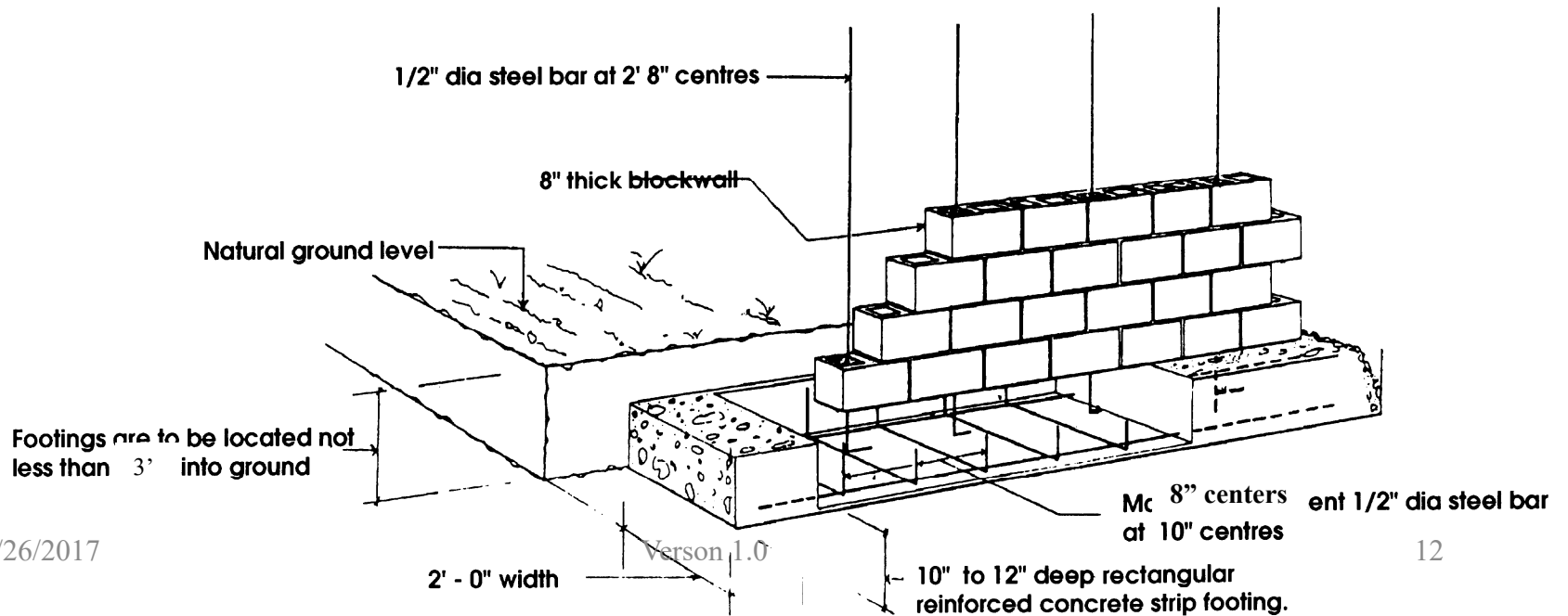
1. To securely anchor the house to the ground to prevent wind forces from lifting the entire building or blowing it over.
2. To transmit the building loads to the ground. Foundations should be securely connected to the rest of the structure and located **not less than 2 feet** into the ground on firm 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.

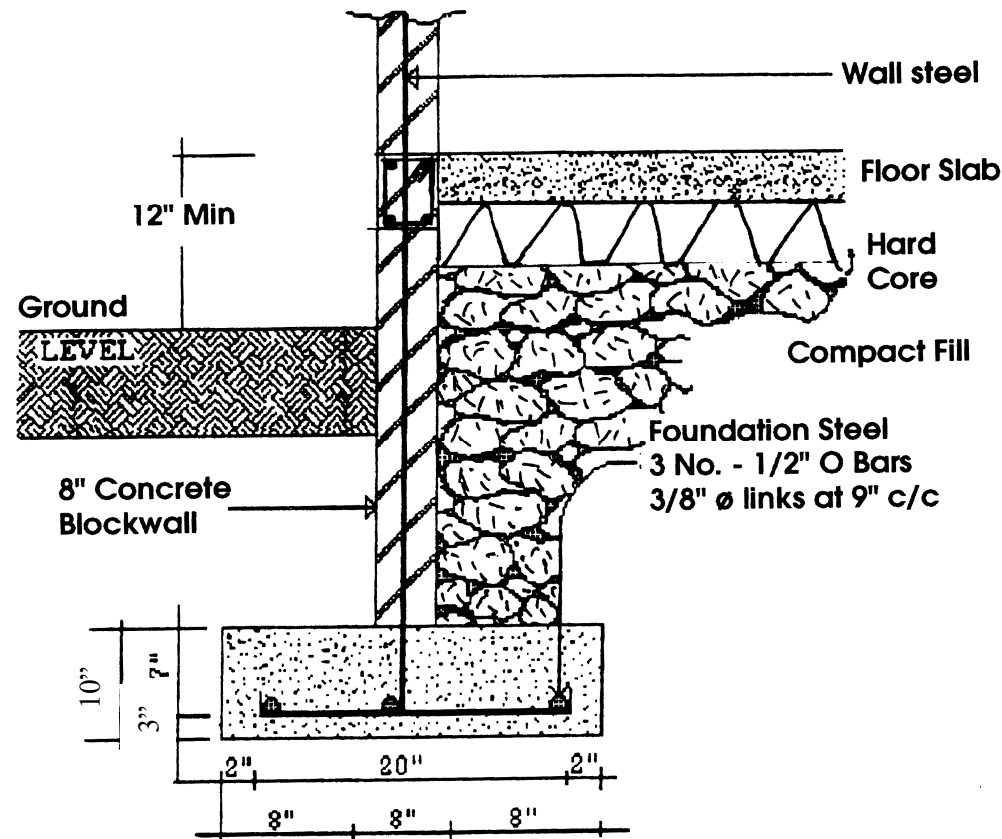
Block walls shall be constructed using running bond instead of stacked bond

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.

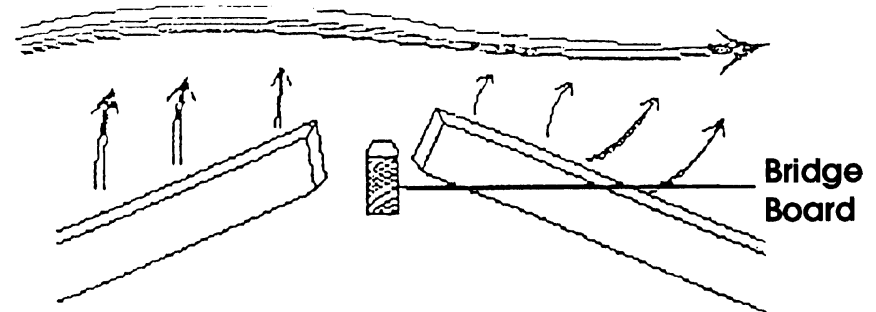


REINFORCEMENT TO STRIPFOOTING

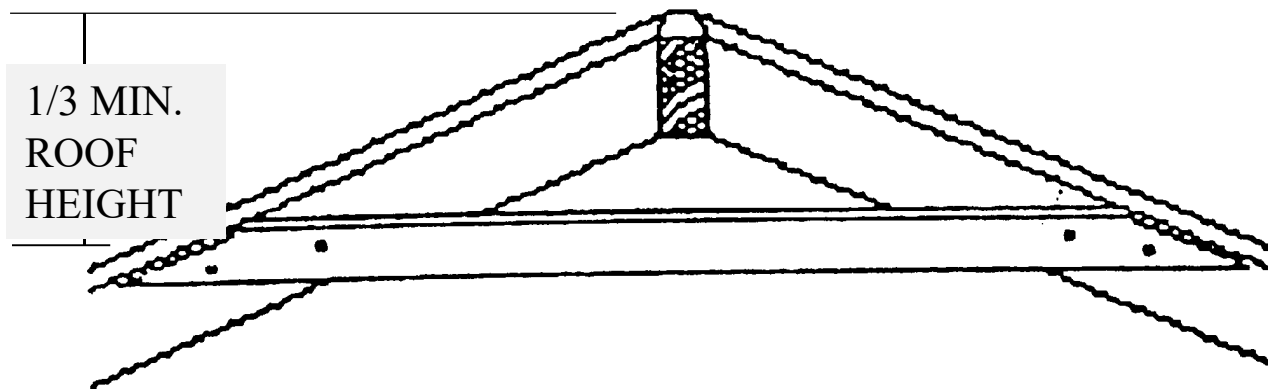
DOMINICA HOUSING STANDARD

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 SHALL BE DONE BY USING:

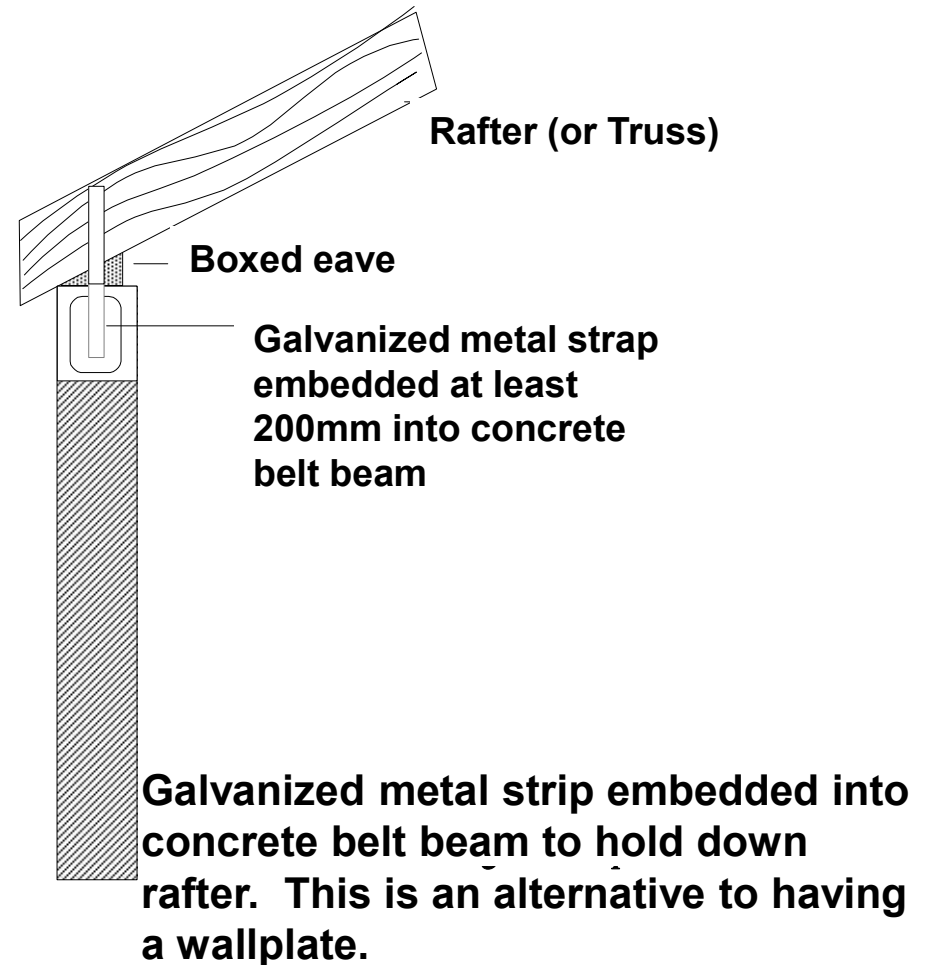
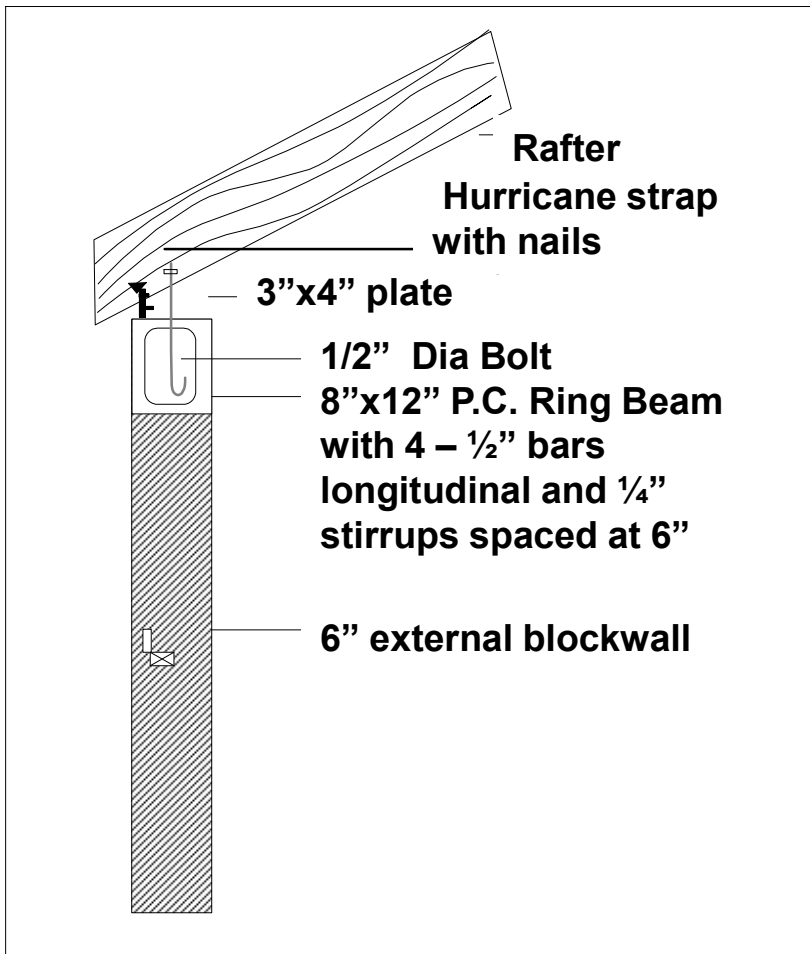


If the rafters are not secure, the ridge can fall apart when strong wind passes over the roof.



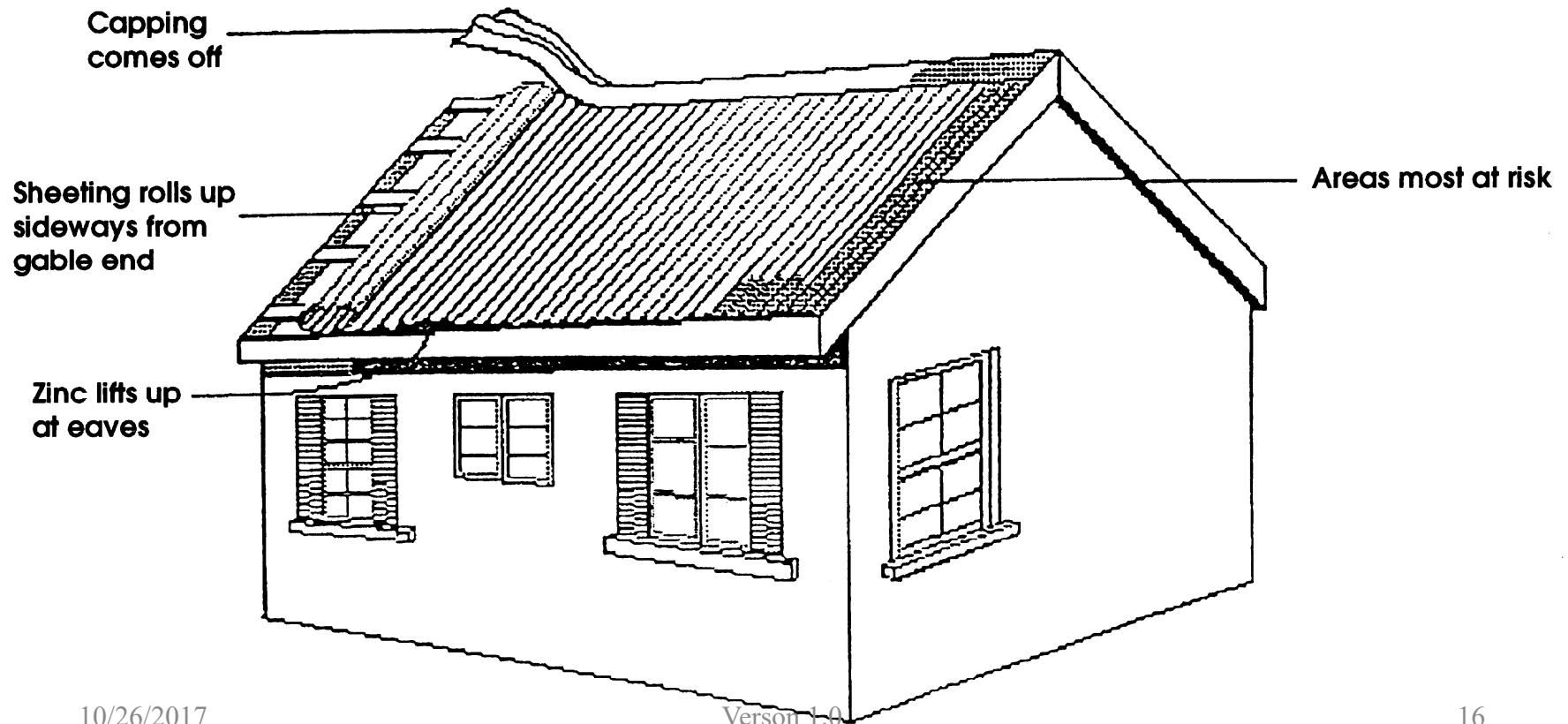
2"x4" COLLAR TIES ON EVERY RAFTER -
Timbers connecting the rafters. Screw them to the side of the rafters, not the face.

ROOF CONNECTIONS FOR CONCRETE WALLS



CORRUGATED GALVANIZED SHEETS ARE GAUGED BY NUMBERS. THE HIGHER THE NUMBER THE THINNER THE MATERIAL. EXAMPLE 24 GAUGE GALVANIZED IS SUPERIOR TO 26 GAUGE.

HOW DOES ROOF SHEETING FAIL IN HURRICANES?

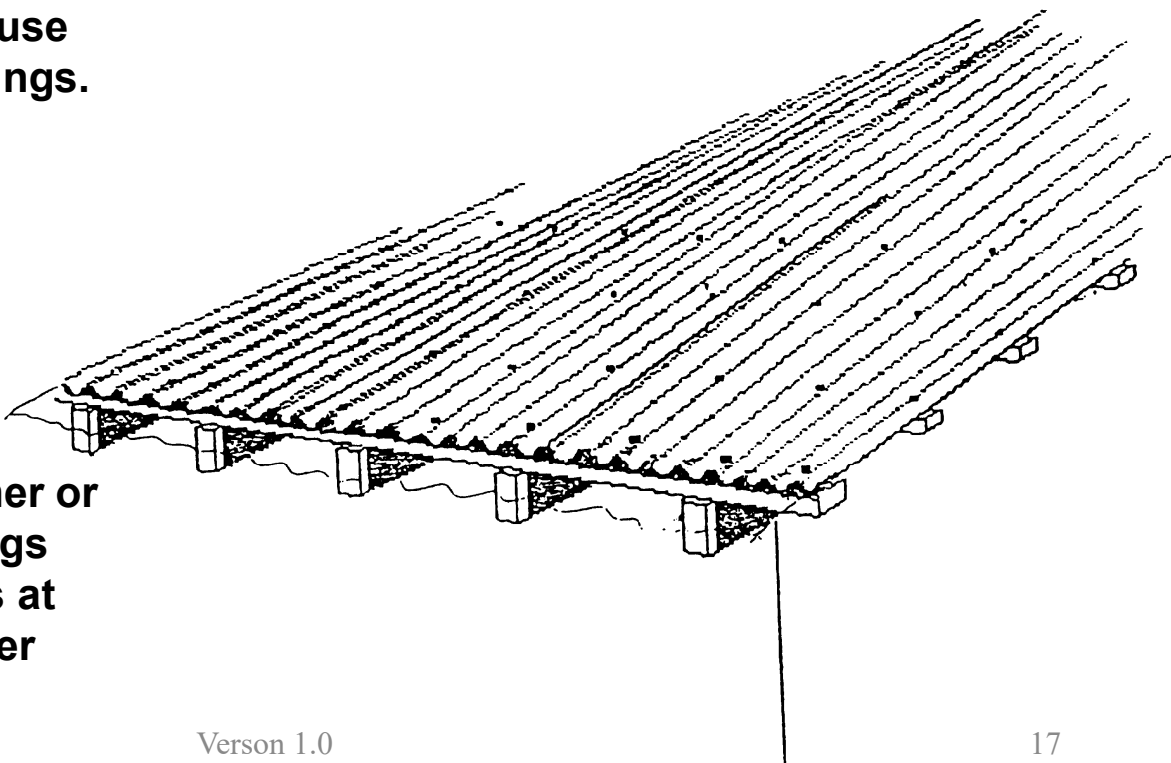
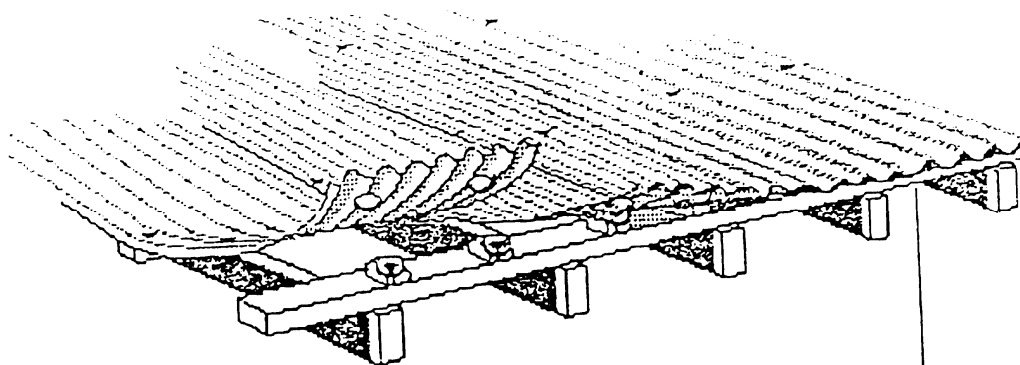


FAILURE IN ROOFS

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

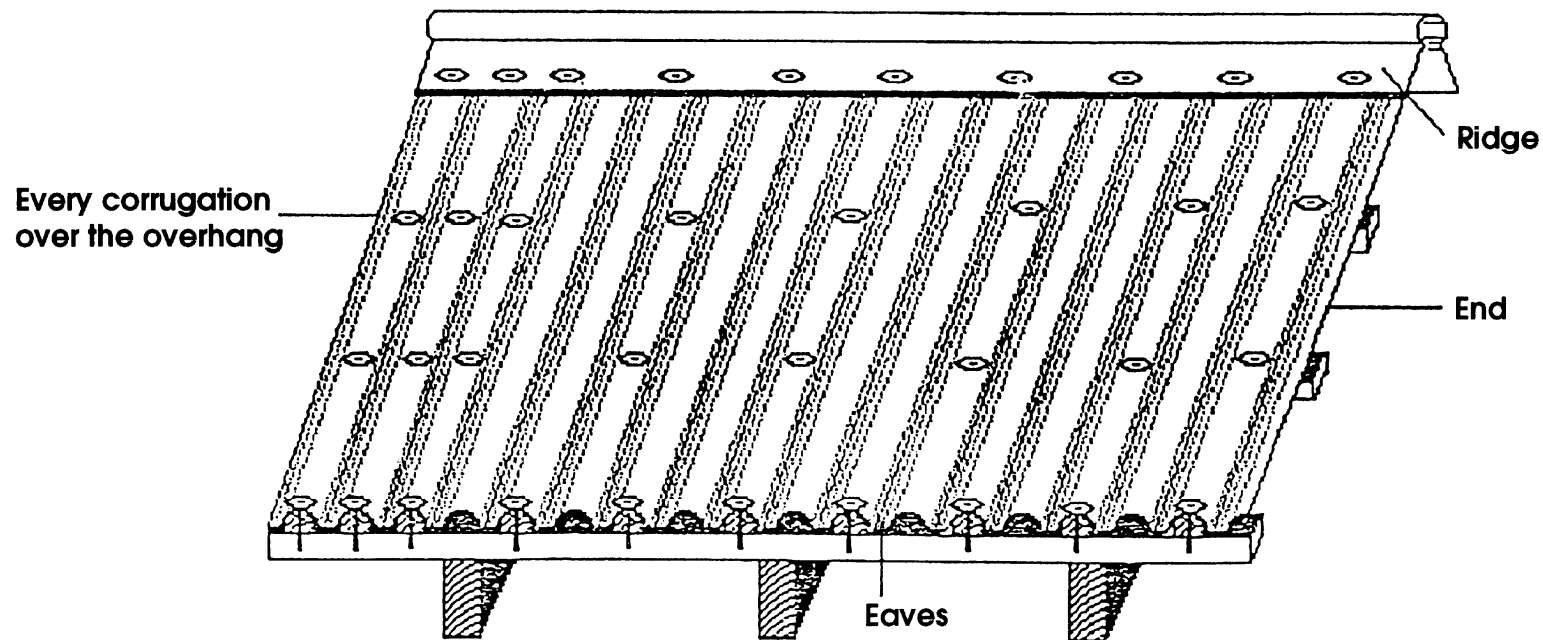
To prevent this type of failure use more fixings for thinner sheetings.

Use fittings with a broad washer or dome head. To use more fixings for each sheet, put in the laths at closer centers and screw closer together.



ROOFING MATERIALS GALVANIZED SHEETS

**WHEN GALVANIZED SHEETS ARE USED 24 GAUGE IS REQUIRED
26 GAUGE SHEETS MAYBE USED ON 1/2" PLYWOOD.**

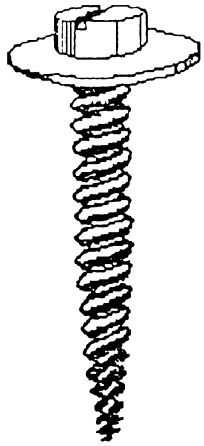


At ridges, eaves and overhangs - #9 screws every corrugation.

All other locations, #9 screws every two (2) corrugation. Maximum spacing.

FIXINGS FOR SHEETINGS

SCREWS



- USE PROPER DRIVE CREWS FOR CORRUGATED GALVANIZED ROOF SHEETS. #9 SCREWS 2 1/2" MIN.

- 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 PULEED UPWARD BY HIGH WINDS.

NAILS



- REMEMBER TO USE SUFFICIENT SCREWS SO THAT THE EHADS WILL NOT TEAR THROUGH.

PURLIN SPACING AND FIXING

- SPACING FOR 2"x4" PURLINS (LATH) SHALL BE 2 FEET AND FIXED TO THE RAFTERS USING HURRICANE STRAPS.

-

DOMINICA HOUSING STANDARD

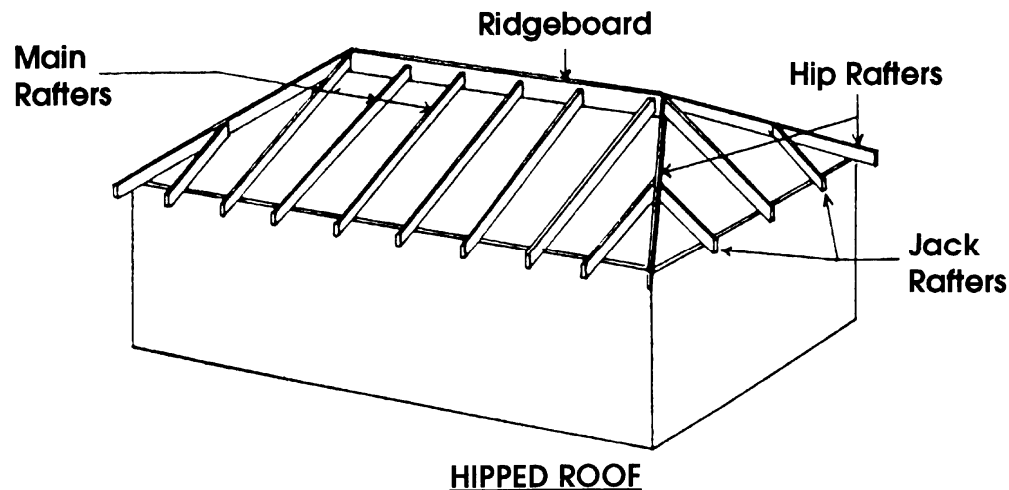
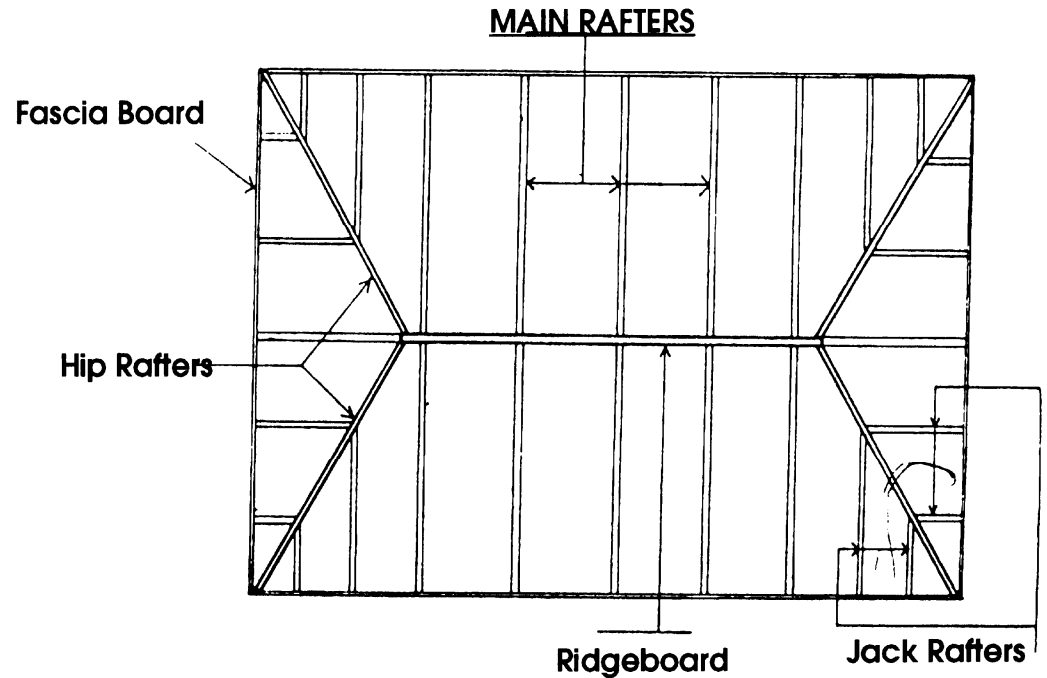
THE ROOF

HIPPED ROOF

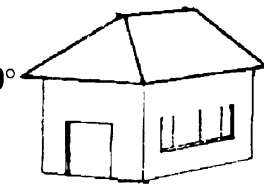
This is the strongest type with all sides of the roof sloped. There are no gable ends in this roof. Instead, rafters come across diagonally from the corner and meet the ridge board a short distance from the ends of the house. These are the hip rafters.

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.



25° to 40°



Hip Roof

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

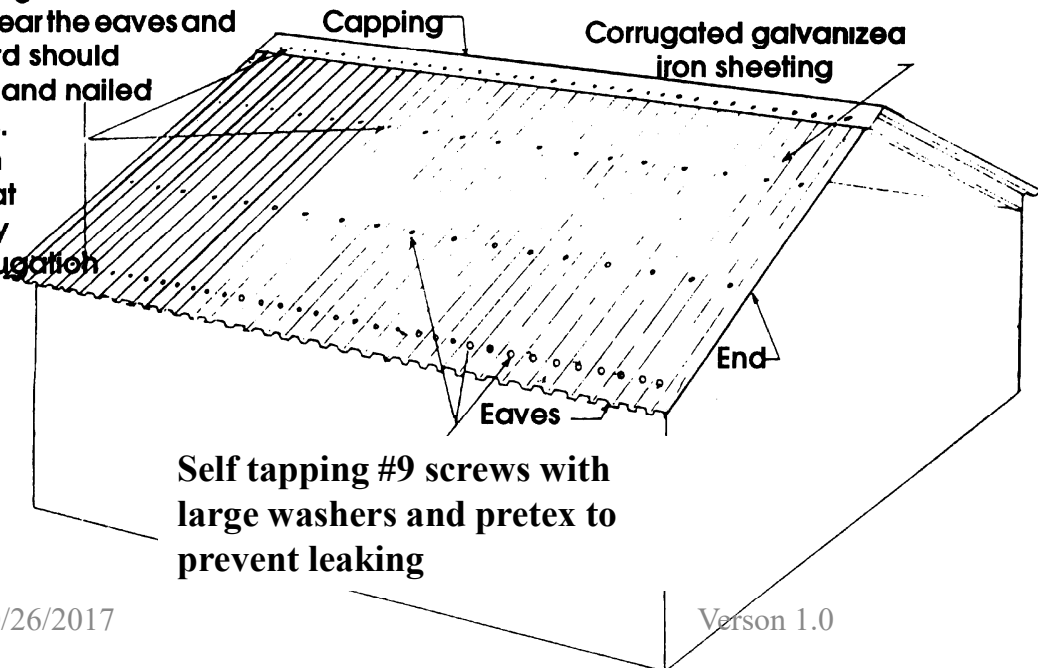
ROOF CLADDING

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 2" x 4" at no more than 2'0" spacing. Purlins should be fixed to each rafter passed over using hurricane straps or metal cleats.

- Sheets should be fixed to the purlins using self-tapping screws.
- At the eaves and ridge as well as the gable ends, the fitting should be two corrugations apart, and for the rest of the roof, no more than three corrugations apart.

CONNECTION OF SHEETING & CAPPING

Every corrugation sheeting near the eaves and Ridgeboard should be bolted and nailed to purlins. For rows in between at least every other corrugation



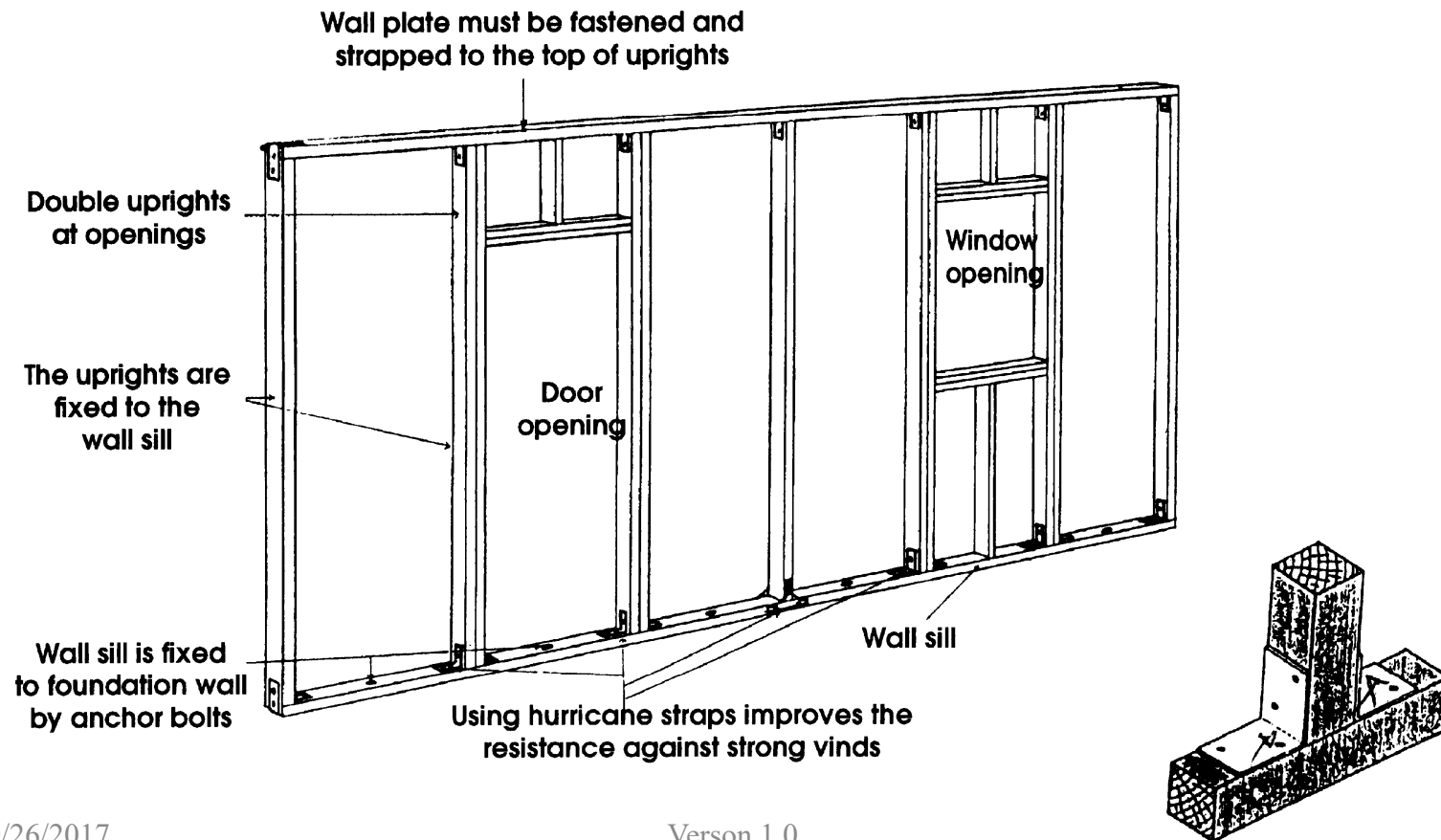
- The corrugated sheeting should be properly overlapped (at least 2 1/2 corrugation) to prevent water from blowing under the seam.
- Roof capping should be made from materials as strong as the sheeting itself, it should be bolted or screwed down to the purlin on either side of ridge or ridgeboard or 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.

WOODEN WALLS

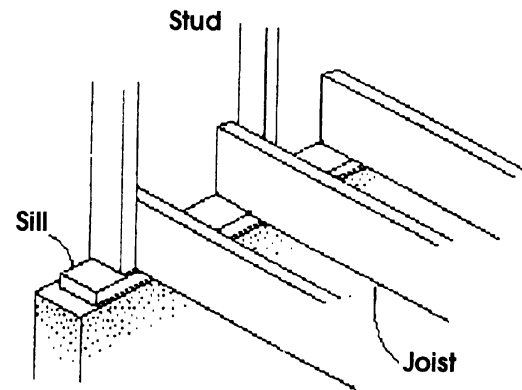
The uprights (or posts) are fixed to the wall sill which is bolted to the foundations wall.

Using metal straps with nails improves the hurricane resistance of timber houses and is required.

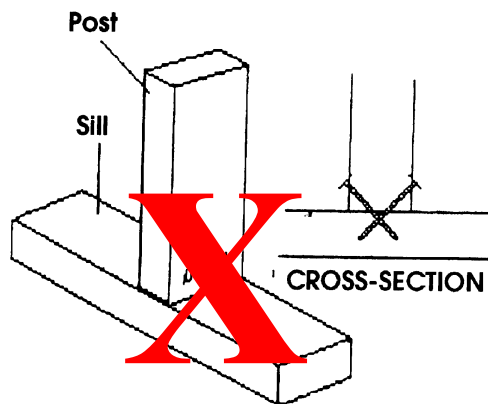
WOODEN WALL



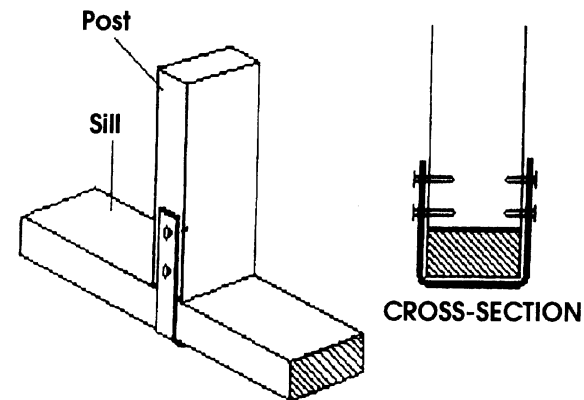
THE WALLS MUST BE SECURELY TIED TO THE FOUNDATION TO PREVENT THE WIND FORCES LIFTING UP THE ENTIRE BUILDING OR BLOWING IT OVER.



CONNECTION FOR TIMBER WALLS



TOENAIL CONNECTION



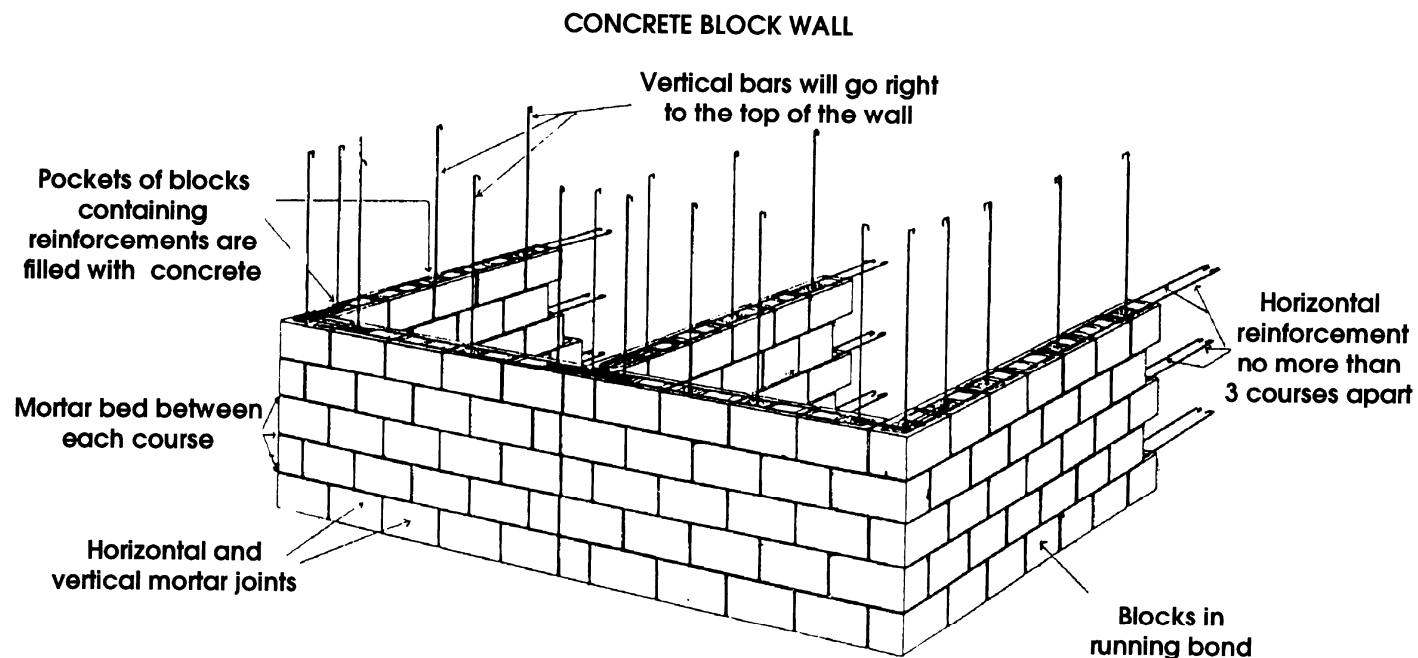
CONNECTION WITH HURRICANE STRAPS

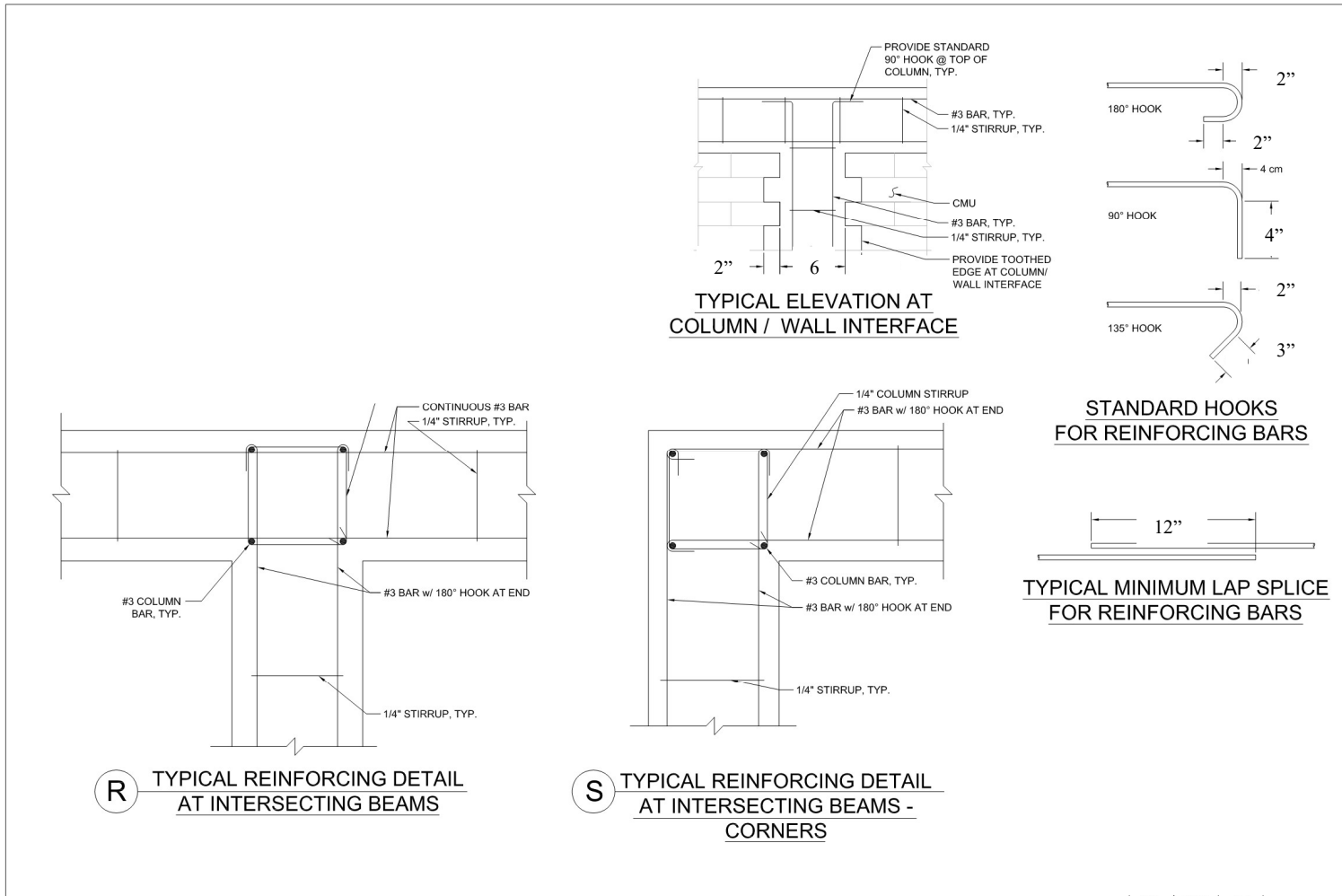
WALLS

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. The minimum vertical reinforcement is **3/8" diameter bars at 32" centres**, this will provide adequate resistance to hurricanes and earthquakes. 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.
- Horizontal reinforcement consisting of two 1/4" diameter bars, Dar-O-Wal or Brickforce, should be laid after every third course.
- 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.
- Corners shall be laced construction





DOMINICA HOUSING STANDARD

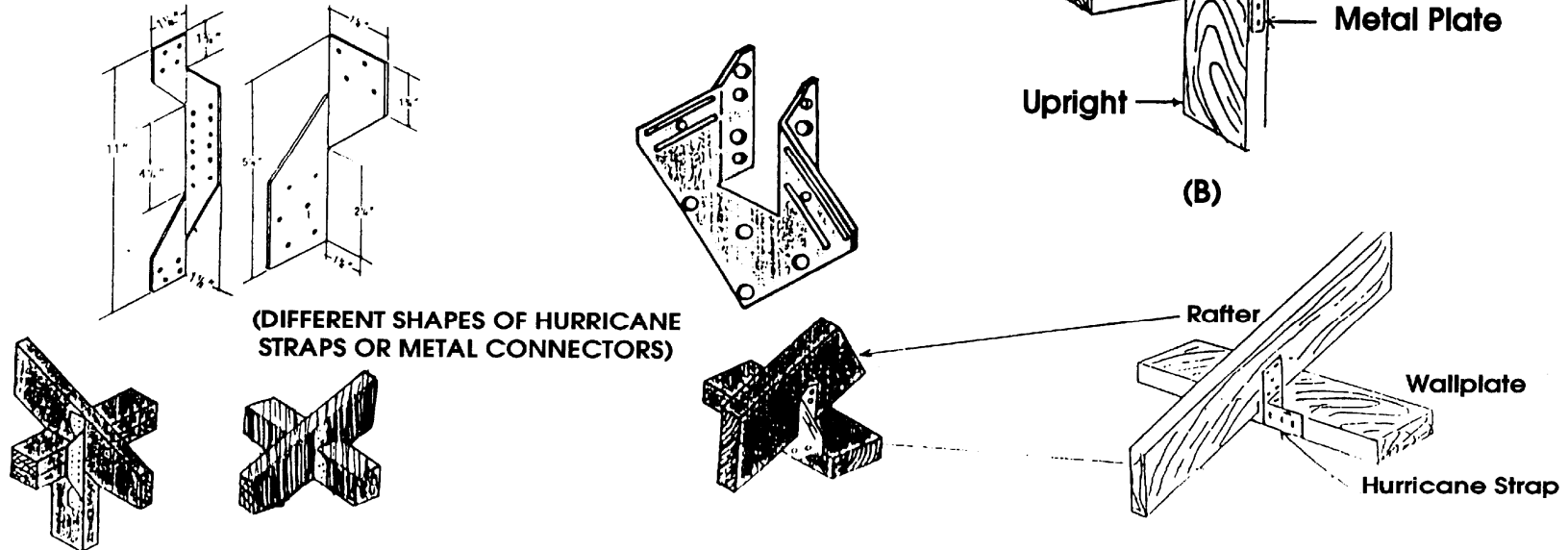
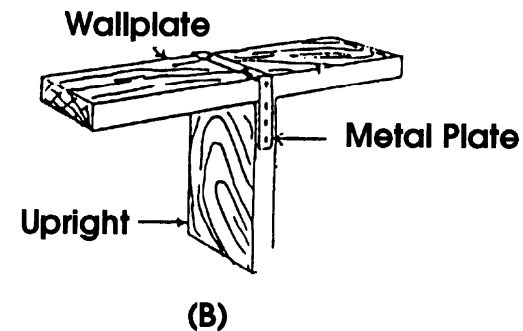
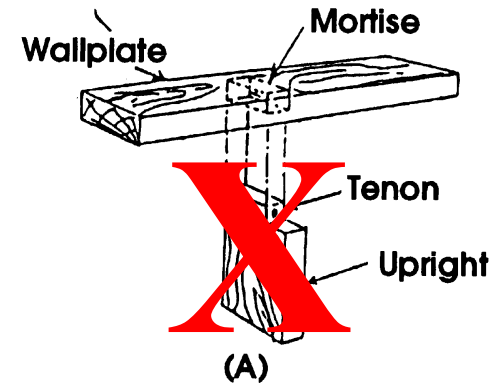
CONNECTIONS

TIMBER WALLS

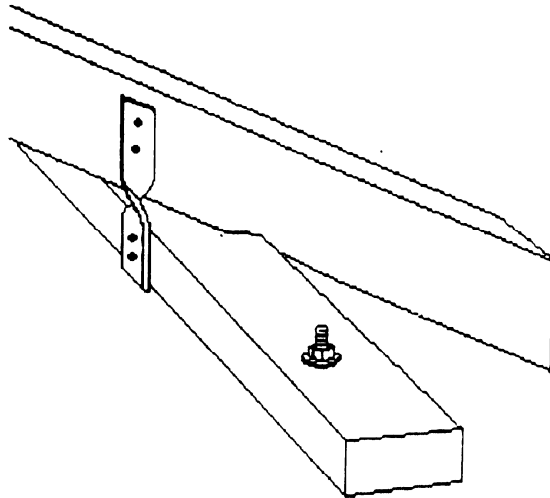
In timber houses the rafters or trusses are connected to a wall plate which is supported by the vertical posts. Two connections need to be considered.

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. It is **REQUIRED** that hurricane straps be used for these connections. Nailing or spiking the rafter to the wall plate is not allowed as under high suction forces these nails or spikes may pull out.

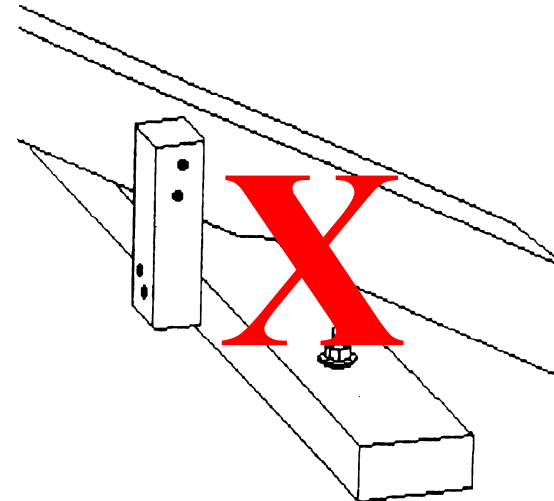
Hurricane straps or metal connectors shall be designed for “High Wind Construction” and have a “High Corrosion” rating.



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

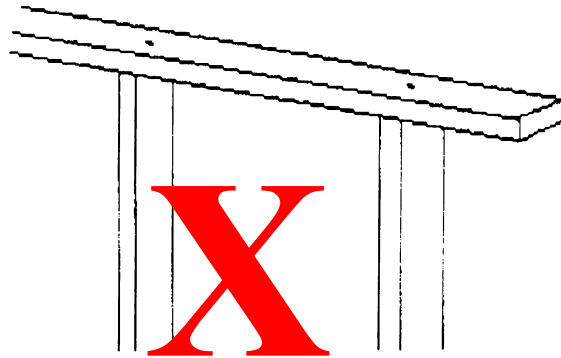


Twisted straps nailed through rafter with 2 1/2 inch nails. Bend over the ends of nails. Be careful when selecting hurricane straps, ensure that they can be properly affixed so that when nailed, the nail is not too near the edge.

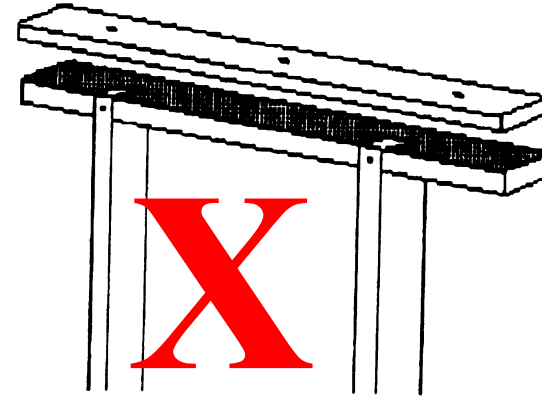


Timber connector may NOT be used as an alternative.

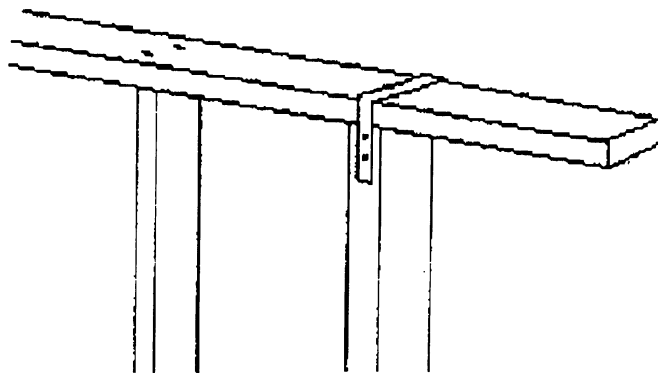
WALL PLATES FOR WOODEN BUILDINGS ARE CRITICAL BECAUSE THEY PROVIDE STIFFNESS FOR THE BUILDING AND ALSO SERVE TO HOLD THE ROOF DOWN.



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

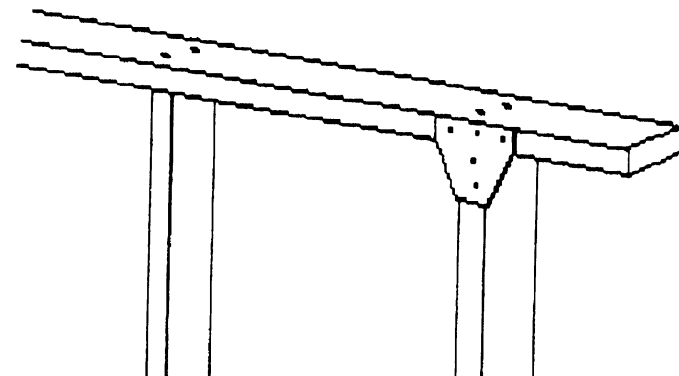


- double plate SHALL NOT be used.



- To strengthen use a strap over the top

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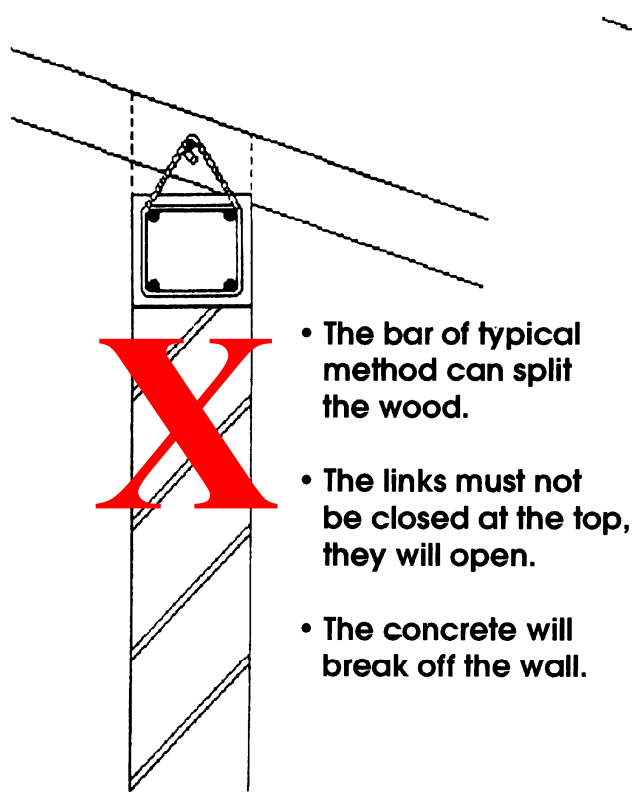


OR

- Use a gusset of zinc or plywood.

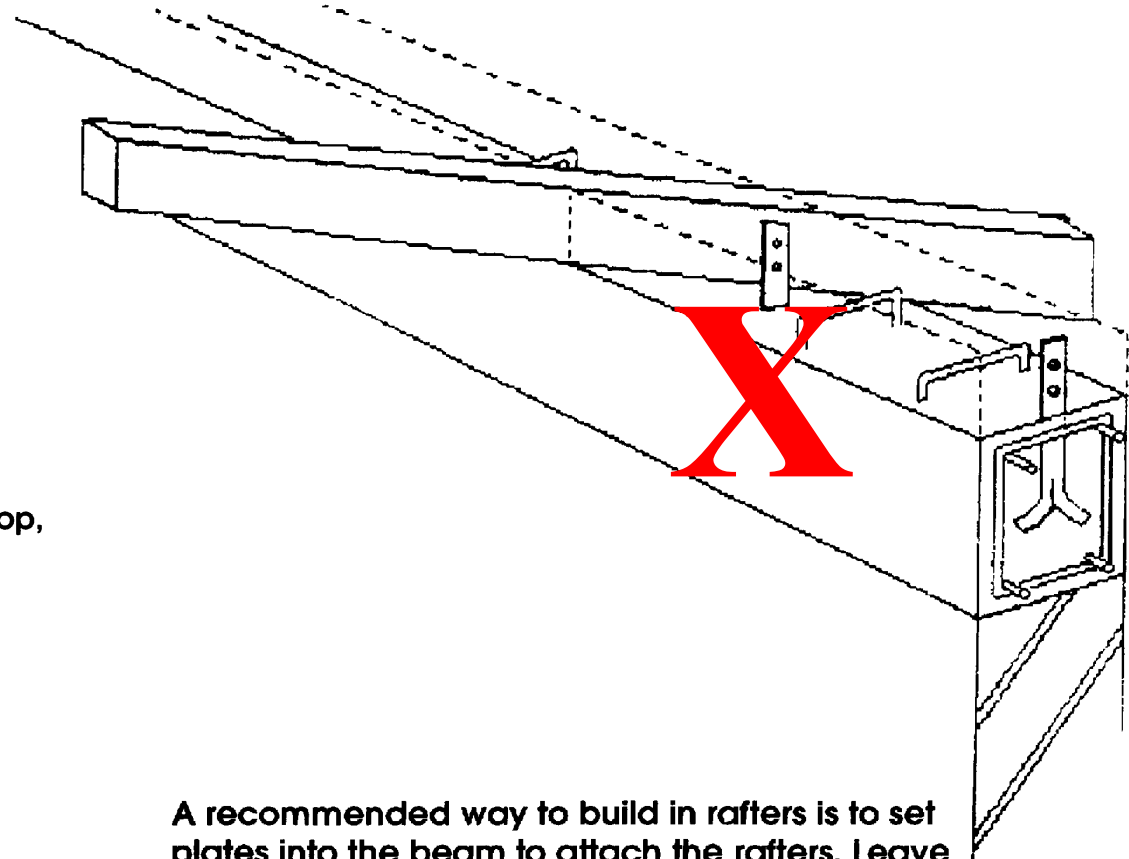
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DUE TO FAILURES OBSERVED AFTER RECENT HURRICANES, RAFTERS MAY NOT BE BUILT INTO THE BELT BEAM AT THE TOP OF THE WALL.



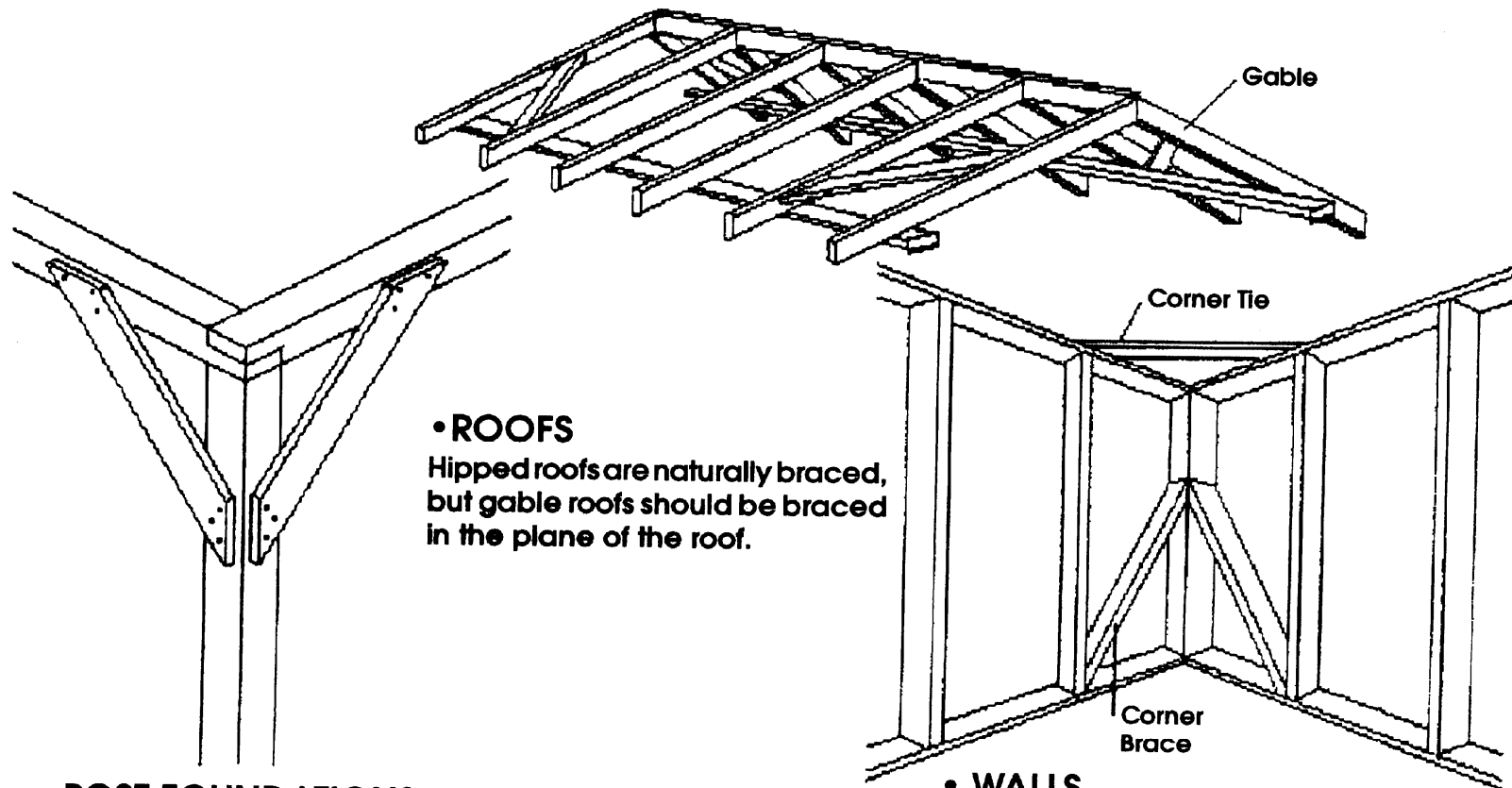
- The bar of typical method can split the wood.
- The links must not be closed at the top, they will open.
- The concrete will break off the wall.

**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.
Plywood or full metal square bracing is also acceptable

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.**