



**GOVERNMENT OF  
THE BRITISH  
VIRGIN ISLANDS**

**HANDBOOK FOR  
HOMEOWNER**



*“It’s better to prepare and prevent rather than repair and repent” – S.Thomas 1856*

*“It’s better to prepare and prevent rather than repair and repent” – S.Thomas 1856*

## Notes

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Refer to item No.6: Approval Sought on the Application for Permission to Develop Land form.

### **F.8. Change of Use Application**

F.8.1. A change of use application is required if the current use of a space or building is different from its proposed use. For example, if a building changes its use from commercial to residential, in a case like this, attributes such as its capacity for sewage disposal and cistern water must be addressed to adequately provide for the number of persons residing or expected to be residing in that building. Application for Change of Use can be done on the Application for Permission to Develop Land form. Refer to item No.8: Land Use of the Application for Permission to Develop Land form.

F.8.2. Change of use filing is required for different commercial uses as well. From beauty salons to food handling, a paint store to a music studio, etc. changes between dissimilar uses within a space must be filed for a new activity.

If a space is planned for an activity that was the same as the current use and if egress patterns remain the same, no change of use application has to be filed. If fire safety compliance changes, an application must be filed and it, in turn, will be referred to the appropriate agency.

### **F.9. Non-Belonger Landholders License**

If the developer is an expatriate, he or she must apply for a Non-Belonger Landholders' License. Contact the Ministry of Natural Resources and Labour for details and procedures. The agent must submit a certified copy by the ministry with the application.

*Please note: All application forms, permits and regulations shown as Appendix 1 can be found at the Building Authority Department and the Town & Country Planning Department.*

## F.5. Advertising Development Proposals

F.5.1. An application for approval of

- Gas stations
- Garages
- Bars
- Clubs
- Restaurants
- Churches
- Noxious or industrial plants (i.e., machine shop)

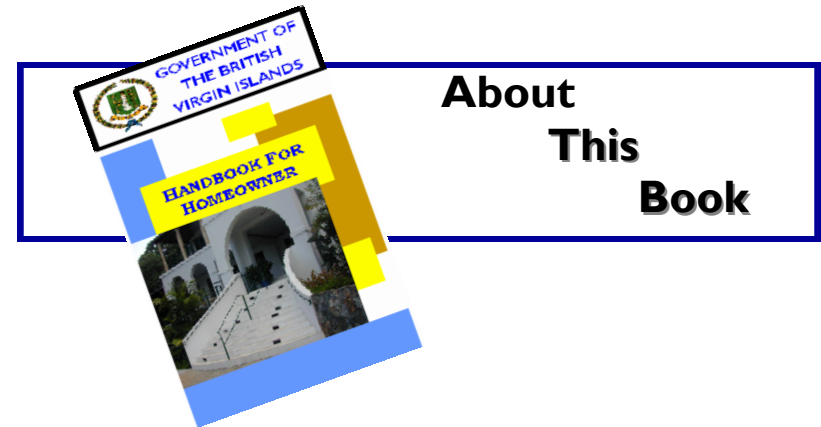
or any public establishment must be advertised by the applicant at his or her expense in the local newspaper in *three consecutive issues*. There is a period of two (2) weeks after final publication in which objections can be lodged with the Development Control Authority. Applications can be viewed within the department and objections can be written and submitted.

## F.6. Commencement of Construction

Commencement of building on any approved subdivision or road construction must occur within twelve (12) months of the date of permit or the permit will be deemed to have lapsed. The owner is required to notify the Department when (setting out) construction begins.

## F.7. Applications for Approval in Principle

Approvals in Principle applications are preliminary conceptual ideas submitted for the Authority's decision. If the decision is positive, these applications are then further developed into more concrete projects. A submission is presented as described in 2(i) "Fee for Application" Land Development (Control) Regulations, 1990, but only with a sufficient number of **preliminary drawings** to convey the idea. If the development includes structures, then their location on the site, supporting amenities, and their sizes and volumes are important to indicate.



## About This Book

### Who Should Use This Handbook?

This Handbook is for new and prospective homeowners to guide and alert them to considerations with regard to safer building practices to withstand the impact of natural and manmade hazards.

### Why Use This Handbook?

To better understand the BVI building regulations with regard to mitigation strategies and making your home safe.

### When Is It Appropriate To Use This Book?

This book should be used prior to home design and purchase or when renovating and repairing existing structure.

### Icons use in this book

The use of this icon alerts the reader to suggested building advice and design considerations.

**Note:** Supplemental information is provided that you may find helpful.



## Handbook Outline

**SECTION 1:** introduces the BVI Building Regulations and things to consider when planning or starting home construction.

**SECTION 2:** covers the selection of the right professionals for the design and construction of your home.

**SECTION 3:** deals with the building design and disaster preparedness.

**SECTION 4:** covers the site preparation with regard to environmental impact assessment and site conditions.

**SECTION 5:** details the materials and infrastructure involved in constructing safe buildings.

**SECTION 6:** deals with building maintenance, insurance issues and a maintenance check list.

**SECTION 7:** covers the procedures of disaster planning and necessary safety equipment needed in the home.

**SECTION 8:** contains appendices including Government documentation or requirements needed for planning approval.

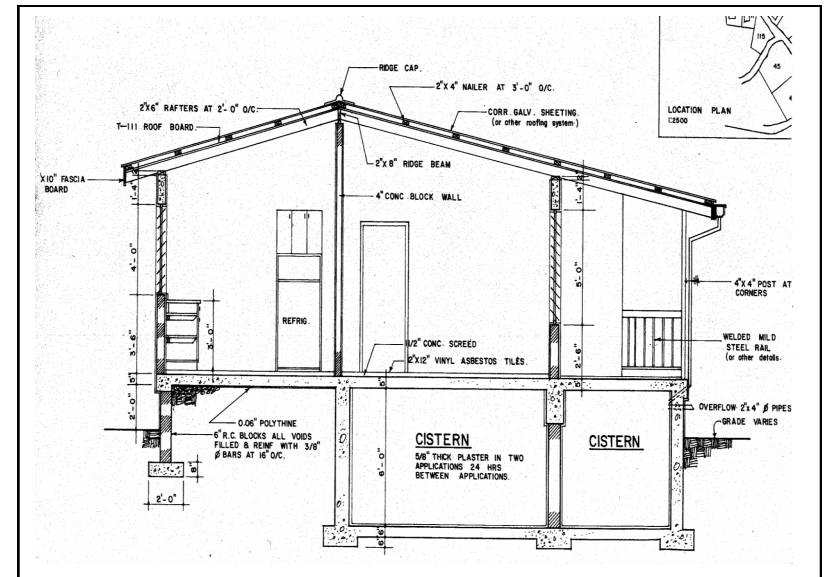
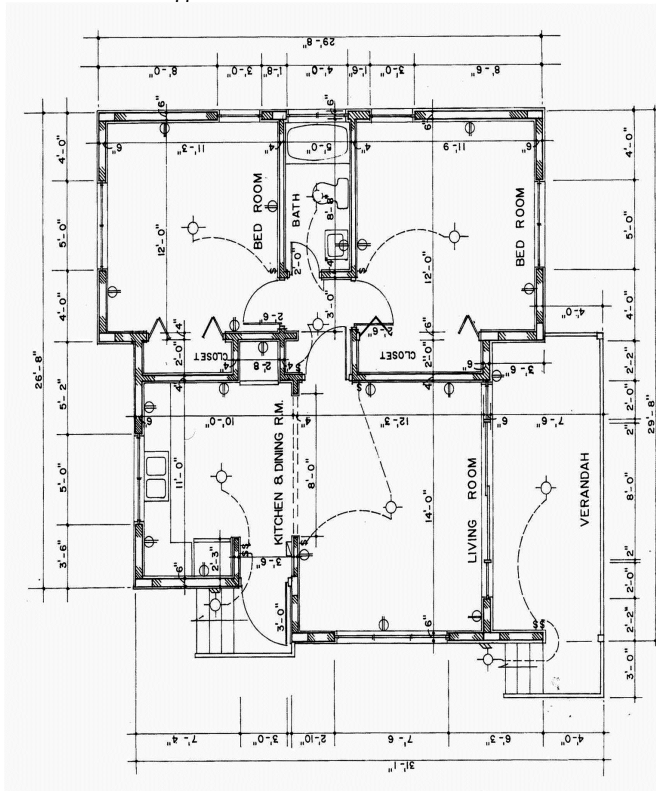


Figure F.3.1.5 – One section of the structure. One is required

### F.4. Proposed Land Use

F4.1 Site plans shall clearly indicate the purpose for which various lots around the applicant's development are being used for, such as

- a) Residential, distinguishing between
  - Single Family
  - Two Family
  - Multiple Family
- b) Commercial, specifically identifying special uses such as
  - Service Station
  - Industrial
  - School Sites, and
  - Parks and agricultural areas



**Note:**  
Submitted drawings shall be at a scale sufficiently large enough to facilitate accurate checking.

Figure F 3.1.3 House Plan

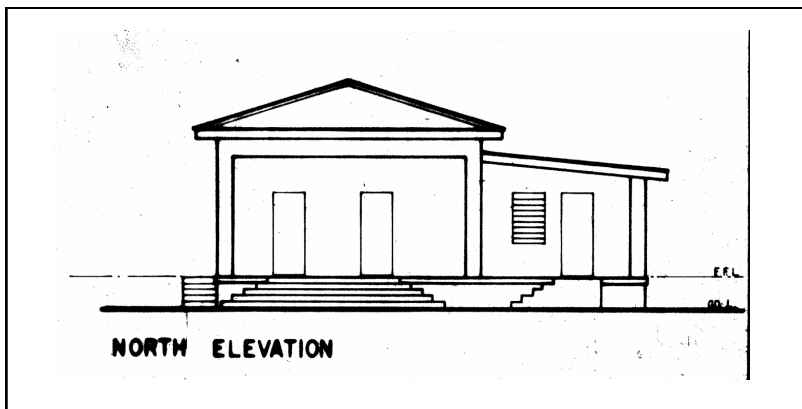


Figure F.3.4 - A typical example of an elevation. Two are required

# Introduction

Recently, the British Virgin Islands has had a construction boom, especially in the area of residential construction. The Land Development Control Authority has been receiving over 40 applications per month.

The BVI is exposed to a number of natural and manmade hazards. The greatest threats come from hurricanes and earthquakes. After Hurricane Hugo in 1989, 30% of the territory's housing stock was damaged. Seismic research has indicated that this region has the potential to experience an earthquake of 7.5 – 8.5 magnitude. Earthquakes of this magnitude have been recorded in the Virgin Islands region during the 18<sup>th</sup> and 19<sup>th</sup> century.

In 1995, the DDM undertook a Hazard and Risk Assessment Project (HRAP) that established the nature of hazards, both natural and man made, to which the BVI are exposed. From the HRAP also came recommendations for a Mitigation and Development Planning Framework. The Mitigation and Planning Programme at DDM is responsible for guiding the work of this Framework. One of the key initiatives in the Framework is Public Information and the need to educate homeowners about the mitigation measures that can be implemented to safeguard their homes and property.

At present, homeownership is on the rise in the BVI. Moreover, a growing number of homeowners and prospective homeowners are acting as architects, engineers, construction managers and contractors for their home projects with little experience in those fields.

With these situations in mind the handbook will guide homeowners in the process and inform them of ways to ensure that they have a safe building that they could enjoy for a lifetime. The handbook includes input from the various public and private agencies that are involved in the homeownership business. The goal of the handbook is to provide information to homeowners about safer

home building, homeownership and home maintenance.

The handbook will provide new, existing and prospective homeowners with tips on buying, building and maintaining their house or home. After reading this handbook, a homeowner should understand the home ownership process, building regulations, and home disaster preparedness.

- The construction specifications of each road.
- Significant features, and
- Existing structures

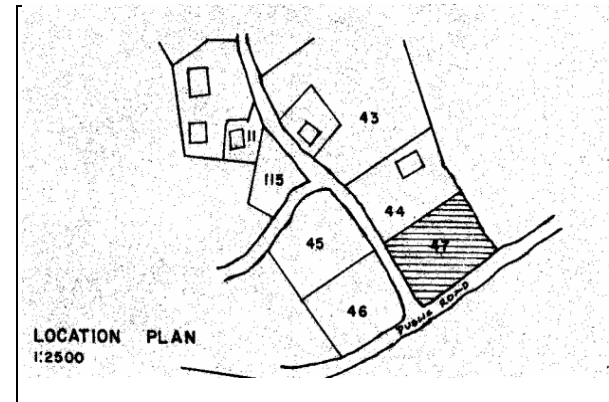


Figure F.3.1.1 - Location Plan

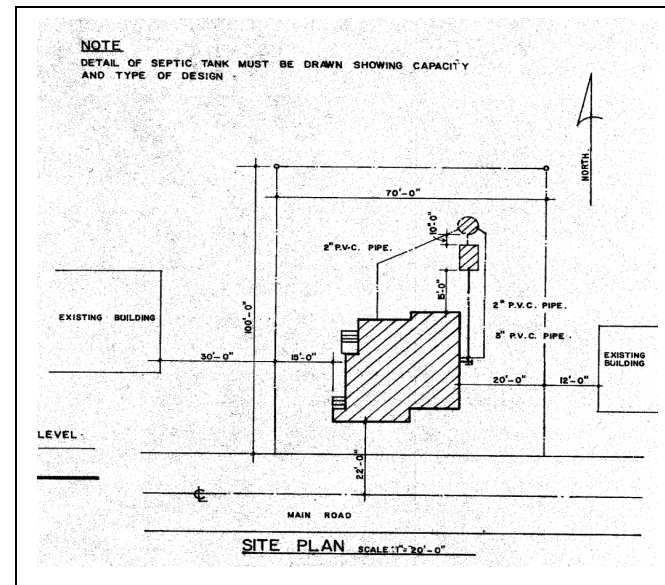


Figure F3.1.2 - Site Plan



The following statement should appear on each subdivision plan for each application and shall be signed by the Surveyor, Town Planner, Architect, or other suitable professional with a valid trade licence etc. as follows:

“I hereby certify that the boundaries of the land to be subdivided and their relationships to the adjacent land are accurately and correctly shown on this plan.”

Signature \_\_\_\_\_

Address \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

A final survey of a layout is not required until The Authority has given approval for the subdivision application. The final survey plan will be compared with the approved layout plan.

### F.3. Building Plans and Layouts

F.3.1. Building plans and layouts shall be provided as follows:

- a. Show the road access to each building lot as well as connections with streets and roads adjoining subdivisions.
- b. Show to the satisfaction of the Authority
  - Site access
  - Road positions
  - Road reserves
  - Existing and proposed contours
  - Cross drainage structures
  - Roadside drainage

## Message from the Minister of Communication & Works

I am pleased to have this opportunity to make a few comments for this very important homeowners handbook.

I am certain that we are all aware that we are located in a zone where there are constant seismic movements and it has been said that a major tremor is long past due.

While hurricanes are annual and natural, the developing world is plagued with manmade disasters resulting from indiscriminate and unplanned earth changes and land divisions caused by developers who want to ensure that every square inch is saleable. This results in erosion and landslides affecting roads and other valuable property.

While the Building Code is an effective tool, fully trained staff must enforce it. The damage and destruction seen elsewhere in most cases are the result of poor construction practices and the absence of code enforcement.

The new Physical Planning Act soon to come into force is an essential piece of legislation that is welcomed. The act sets clear the false notion that “excavation is not development”. It is imperative that we make not only developers responsible for planning violations, but we also hold excavation equipment operators responsible for executing instructions that they know are in violation of the regulations.

Another contributor to disasters is the lack of regulations, which should require professional architects to meet some minimum prerequisites before being issued a license to practice. I am pleased to announce that such legislation is presently being developed.

Please be reminded that we cannot compete with Mother Nature, but we can design and build to minimize disasters and the loss of life and property. Therefore, select your professionals carefully, respect the building and planning guidelines and be considerate of your neighbours and potential threats to the public roads and structures.

*Paul P. Wattley*  
*Minister of Communication & Works*

## **F.2. Subdivisions Applications**

Where it is desired to construct more than one structure on any area of land, a subdivision plan must be submitted to the authority for approval.

(1) Applications for subdivisions shall be in the form set out in schedule 1 a) and b). (Refer to Land Development Control Guidelines – 1972 Guidelines No.17 and No.18)

a) Where it is desired to construct more than one house on any area of land

b) Drawings shall be drawn to scale sufficiently large to facilitate accurate checking.

Subdivision plans shall be accompanied with a location sketch showing existing subdivisions in the vicinity and names of owners of properties adjoining the proposed subdivision registered on the cadastral;

A subdivision plan also includes contours, road positions, road reserves, cross drainage structures, roadside drainage, and the construction specifications for each road shown to the satisfaction of the Development Control Authority.

F.1.2. The plans to be submitted the office of the Town and Country Planning Office along with the application form(s) must be created or designed by an appropriate professional who must have a suitable level of experience and qualifications in one or more of the following areas: **surveying, physical planning development, architecture, architectural engineering, civil or structural engineering, drafting etc.**

F.1.3. This person will be called the agent for the application. If this person is a surveyor he/she must be a **licensed** surveyor. In the case where the agent is not a surveyor he/she must possess a **valid trade license**.

F.1.4. Prepared plans will not be accepted upon submission as being done by the applicant/owner who claims to be the agent as well, except if this person (owner or applicant) meets the criteria for one of the professionals described above.

F.1.5. A building plan consists of, with suggested scales:

1. A location plan, 1:2500, including north arrow, with block and parcel numbers;
2. A site plan, 1:10, to 1:100. Include a point of reference, natural – ghut, rocky formation, body of water, or manmade – a ruin, or a well-known physical structure;
3. Floor plans,  $\frac{1}{4}'' = 1' - 0''$  minimum.
4. Two elevations,  $\frac{1}{4}'' = 1' - 0''$  minimum
5. One transverse or longitudinal section,  $\frac{3}{8}''$  or  $\frac{3}{4}'' = 1' - 0''$
6. Details, including the septic and soak away system

If the design changes as a result of construction document development, a revised set of drawings must be submitted to this department. For more on building plans, refer to the section on Building Plans and Layouts in this section below.

## **Message from the Chief Physical Planning Officer**

The Town and Country Planning Department was pleased to participate in the development of the "Handbook for Homeowners". Hazard mitigation is very closely tied to development planning thus the responsibility to prepare is a shared one. Like Disaster Management, Physical Planning is critical to all phases of the disaster management cycle.

This document is one of many initiatives to address the management of natural and man-made hazards with respect to our geographical location. Improved quality of construction and being mindful of site selection will, therefore, improve our ability to reduce recovery time after an event. These seem simple enough, however, the knowledge as to how to do it needs to be available to more future property owners before they build.

In the Town and Country Planning Department, the examination process for development applications reviews how a development addresses these issues with respect to coverage, setback, access and proper control of and use of physical infrastructure (actually discussing septic, power, etc.) The Building Authority covers structural issues. Environmental Health Division is responsible for waste, vermin, etc. This book brings them all together.

The National Integrated Development Strategy objectives include several aspirations that can be applied to this project:

Reduce vulnerability;  
Ensure balanced development;  
Ensure environmental sustainability, and  
Improve the physical infrastructure.

The "National Mitigation Policy for the British Virgin Islands " states:

*The strategy outlines a multi-sectoral, multi-disciplinary approach to integrated management of natural and man-made hazards, through all phases of the disaster management cycle, namely, prevention, mitigation, preparedness, response, recovery and restoration."*

Better information produces better results. We cannot afford to rebuild after each disaster. Let's keep the British Virgin Islands a safe, and enjoyable place to live and work.

Thank you.

***Louis Potter***  
***Chief Physical Planning Officer,***  
***Town & Country Planning Department***

## **Appendix 2: Application Submissions Standards**

### **F.1. Land Development Applications**

F.1.1. Application for land development shall be in the form set out in Schedule 1 (a) and (b) hereto. (Refer to Land Development Control Guidelines – 1972 Guideline No.17 and No.18.)

- a) Drawings shall be made originally either in ink or pencil and prints made. Each application form must be duplicated at least three (3) times and be accompanied by at least three (3) printed copies of drawings. In cases of Land Development planning where referrals to other agencies are required, more than three copies may be requested.
- b) Drawings shall be drawn to scale sufficiently large to facilitate accurate checking.
- c) Each drawing must have a title block containing the following information:
  - The name of the agent that prepared the drawings,
  - The agent's address, contact number, or email address,
  - The name of the owner and applicant,
  - The name of the project,
  - Parcel and block information,
  - The scale of the drawing (or indicate appropriately if using several),
  - Date of the plan and signature(s) of the person(s) who prepared the plan.

VIRGIN ISLANDS  
STATUTORY INSTRUMENT 1990 NO. 30

LAND DEVELOPMENT (CONTROL) ORDINANCE  
NO. 3 OF 1969

LAND DEVELOPMENT (CONTROL) REGULATIONS, 1990  
[Gazetted 11<sup>th</sup> October, 1990]

The Governor in Council in exercise of the powers conferred by section 22(1) (c) of the Land Development (Control) Ordinance makes the following Regulations:-

Citation	1. These Regulations may be cited as the Land Development (Control) Regulations, 1990.
Fee for application	2. A fee determined in accordance with the rates specified in the Schedule hereto shall be payable in respect of every application under sections 7 and 8 of the Land Development (Control Ordinance)

SCHEDULE

(a)	where the development entails sub-division of land:- (i) for the first five sub-divisions (ii) for each additional sub-division	\$20.00 per subdivision \$10.00
(b)	where the development entails display of advertisements on land - in respect of each advertisement.	\$2.00 per sq. ft. (per exposed face)
(c)	where the development entails the construction of a residential building (i) where the aggregate floor area does not exceed 1200 square feet (ii) where the aggregate floor area exceeds 1200 square feet but does not exceed 3000 square feet or part thereof (iii) for every additional unit of 1200 square feet over 3000 square feet or part thereof	\$0.05 per sq. ft. \$0.07 per sq. ft. \$0.10 per sq. ft.
(d)	where the development entails the construction of a non-residential building (whether commercial or otherwise) or a mixed use building (containing both residential and non-residential uses)	\$0.15 per sq. ft.
(e)	where the development entails the construction of other structures (whether jetties, retaining walls, cisterns or other wise)	\$0.15 per sq. ft. of covered ground
(f)	where the development entails the layout cutting, surfacing or otherwise of a road which is not part of a sub-division application	\$50.00
(g)	where the development entails mining of any form	\$100.00
(h)	where the development entails a change of use	\$100.00
(i)	in respect of an application under section 8(1) of the Ordinance for approval in principle (such fee will be deducted from the cost of a subsequent application for full approval under section 7); and	\$100.00
(j)	in respect of a renewal of an approval where an approval has lapsed	\$50.00

## Message from the Director of Disaster Management

One of the most effective means of protection is to take steps to make your home and your household safe from the potential effects of disasters like floods, hurricanes and earthquakes. Ideally, mitigation measures are implemented before disaster strikes since they can help protect your household as well as your property. However, even after a disaster strikes, actions should be taken to avoid or reduce the impact of the next disaster.

The Handbook for Homeowner was compiled by the Mitigation and Planning Programme of the Department of Disaster Management in conjunction with Town and Country Planning Department to provide homeowners with practical mitigation measures on how to best prepare your home and property for the effects of disaster events, which may affect the BVI territory. It includes tips on getting started, choosing the right professional and safer building design.

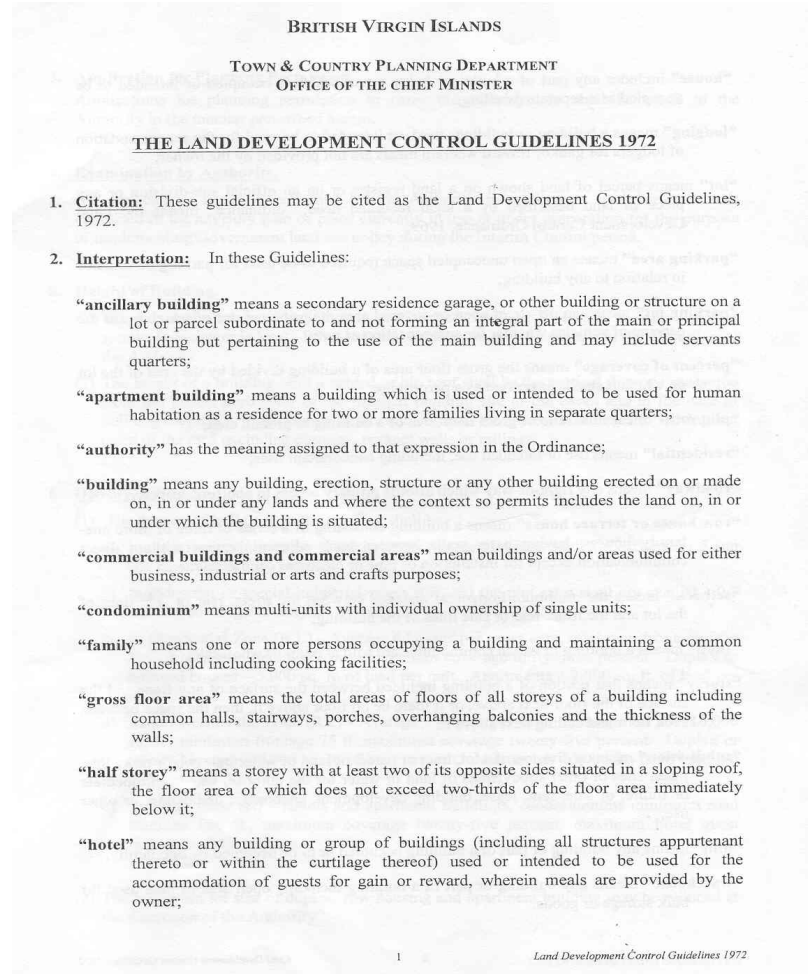
We know that disaster preparedness works. We can take action now that will help protect our families, reduce the impact an emergency has on our lives and property, and deal with the chaos if an incident occurs near us.

The production of this handbook could not have been possible without the support of funding provided to the Caribbean Disaster Emergency Response Agency (CDERA) under the Caribbean Hazard and Mitigation Project (CHAMP) which is designed to reduce vulnerability to natural hazards in the Caribbean through the development and implementation of safer building techniques. We hope that our readers will find this information beneficial.

*Sharleen S. DaBreo*  
*Director, Department of Disaster Management*

# Acknowledgements

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Photographs	Department of Disaster Management Caribbean Disaster Mitigation Project www.google.com (images)
References	Caribbean Disaster Mitigation Project



# Section 1: Getting Started

## 1.1 BVI Building Regulations


The Building Regulations 1999 applies to the design and construction of new buildings and the alteration, reconstruction, demolition, removal, maintenance and occupancy of existing buildings or any appurtenances connected to or attached to such building or structures.

Section 19 of the Building Ordinance (Cap.234) provides a mechanism for the making of detailed regulations to regulate building standards in the Territory. The Ordinance also provides an enforcement mechanism to ensure adherence to any regulations made thereunder. The making of such regulations is particularly relevant considering the natural hazards (such as hurricanes and earthquakes) that affect countries in the Eastern Caribbean region, including the British Virgin Islands. The Building Regulations, 1999, therefore, place emphasis on the development of building standards which would prevent or mitigate damage arising from natural hazards.

The Regulations, in effect, provide administrative and enforcement mechanisms relating to building practices and the use of acceptable materials and building systems. They also provide for the approval of any system or material which can be demonstratively proven to be resistant to natural hazards. Furthermore, the Regulations address issues pertaining to public health and safety in the construction of buildings, precautions to be adopted during building construction, provision of water supply services, and the regulation of sewage and waste disposal, plumbing, solid waste disposal, electrical and mechanical installations, dead and live loads, excavations and foundations, timber construction, concrete masonry, plain and reinforced concrete, structural steel construction and the construction of small buildings.

REVISED JANUARY 2000

GOVERNMENT OF THE BRITISH VIRGIN ISLANDS  
BUILDING AUTHORITY



VIRGIN ISLANDS BUILDING ORDINANCE (NO. 10 OF 1955)

DATE: \_\_\_/\_\_\_/2004 APP. # \_\_\_/2004

TO CLERK  
BUILDING AUTHORITY  
VIRGIN ISLANDS

1. In Accordance with section 6 of the Building Ordinance:  
Applicant's Name:.....  
Address:.....  
Phone #:.....  
Agent's Name:.....  
Phone #:.....  
Hereby give notice that I intend to erect a New Building, Reconstruct and Altar a Building, remove a building within the prescribed area of .....

2. Adjacent property owners have been notified of my intent  Yes  No

3. I attach hereto a complete set of plans and set out below a statement of the particulars.

SIGNED.....

NOTE: Strike out words that do not apply.

STATEMENT OF PARTICULARS

(I) Cadastral Section.....Sheet No.....Parcel No.....  
(II) Building Material.....  
(III) Position from and dimension.....  
(IV) Distance from road.....  
(V) Distance from adjoining buildings.....  
(VI) Purpose for which building is intended.....  
(VII) Sanitary arrangements if to be used as dwelling.....

Homeowners are advised to obtain a copy of the Building Regulations prior to the design and construction of their home.

**1.2 When you are ready to build:**

1.2.1 Prepare a budget and use it to keep the track at all times. There are many products and construction methods that are available in various price ranges.

1.2.2 Financing: Before you start anything you might want to talk to your bank or a mortgage company to make sure you are able to get the money needed to complete the house.

**Banks and Loans**

Approval is based on the applicant's credit worthiness, (taking into consideration present and past credit performance), job and residence stability, and the financial ability to service the loan.

The maximum amount the bank would finance for a construction loan is 80% of the appraised value of the property, inclusive of the value of the land. The estimated interest amount payable during the construction stage is worked into the loan. If the loan is approved, an origination fee, legal fees, interest and escrow adjustments would be deducted from the requested amount.

**Note:** *Don't forget to budget for the driveway, sidewalks, landscaping, fencing, blinds and maybe even some new furniture or appliances.*

1.2.3 Plans: You could either find a suitable building lot and then a plan to suit the lot, or if money is not a problem and you have your heart set on a specific plan, first get your plans and then a lot to suit the plan.

Before you choose a plan, take into account your lifestyle and your budget. It is very easy to go over budget or choose a plan that

*"It's better to prepare and prevent rather than repair and repent" – S.Thomas 1856*

**GOVERNMENT OF THE VIRGIN ISLANDS  
BUILDING AUTHORITY**

  
**Building Permit Application**

DATE: / /2004 PERMIT NO.: BP 04/

The undersigned respectfully makes application for a permit to

Cadastral Section \_\_\_\_\_ Sheet No. \_\_\_\_\_ Parcel No. \_\_\_\_\_

Site Location \_\_\_\_\_

Property Owner \_\_\_\_\_ Phone \_\_\_\_\_

Contractor \_\_\_\_\_ Phone \_\_\_\_\_

Address \_\_\_\_\_

Plans prepared by \_\_\_\_\_ Phone \_\_\_\_\_

Estimated Cost of building completed \_\_\_\_\_

Total building square footage \_\_\_\_\_

Type of Construction: Residential \_\_\_\_\_ Commercial \_\_\_\_\_ Institutional \_\_\_\_\_ Renovation \_\_\_\_\_ Addition \_\_\_\_\_

Application is hereby made to obtain a permit to do work as indicated. I certify that no work has commenced prior to the issuance of a permit and all work will be performed to meet the standards of all laws regulating construction in the British Virgin Islands.

OWNER'S AFFIDAVIT: I certify that all the foregoing information is accurate and that all work will be done in compliance with all applicable laws regulating construction in the British Virgin Islands.

Signature \_\_\_\_\_ Date \_\_\_\_\_  
I HAVE APPLIED

P.O BOX 284 • BAUGHER'S BAY, TORTOLA • BRITISH VIRGIN ISLANDS  
PHONE: 284-494-2722 EXT. 5750/5748 • FAX: 284-494-4740  
email: pwd@mailbvigovernment.org

*"It's better to prepare and prevent rather than repair and repent" – S.Thomas 1856*



# Section 8: Appendices

## Appendix 1: Useful Requirements, Regulations and Policies

### *Building Application Permit Request Form*

**BUILDING AUTHORITY**

Public Works Department  
 P.O. Box 284  
 Road Town, Tortola  
 British Virgin Islands  
 Phone: (284) 494-2722 Fax (284) 494-4740

**Building Permit Request Form**

Permit No.:BP 04/

Date: \_\_\_\_\_

File Ref. No.: /2004

Requested By: \_\_\_\_\_

Phone No. \_\_\_\_\_

Request Received By: \_\_\_\_\_

INSPECTIONS	QUANTITY	DATE	COST	RECEIPT NO.
1) APPLICATION				
2) FOOTINGS				
3) MAIN SLABS				
4) COLUMNS				
5) BEAMS				
6) ROOF CONNECTIONS				
7) RETAINING WALLS				
8) FINAL INSPECTOINS				

looks ideal on paper, but does not suit your family. There are many design books on the market or you could hire an architect or a home designer to design a house for you. Make sure you have enough copies of your plan, 10 would be really nice. Your building permit will take 2 or 3 copies and you will probably have to leave a plan at your place of lending. That leaves you with 6 or 7 copies left. Many of the sub trades need a plan to price out their work, make sure you remember who has a plan and get it back when they are finished with it. Most subdivisions will require a set of plans

1.2.4 Land: Put an offer on the parcel of land, subject to financing and in certain subdivisions subject to the building scheme.

1.2.5 Estimates: Get cost estimates from all the sub trades needed to complete the job.

Make sure that you get several quotes from each sub trade, at least 3 or more, stick to REPUTABLE companies and you will be able to ELIMINATE a lot of problems afterwards. Compare all the quotes to make sure they include the same materials and work, and of course the quality of the material. Cheaper is not always better. Have the material list checked by someone who knows a little about it. Do not be afraid to ask questions.

1.2.6 Getting Organized: Now you need to choose the right professionals.

- 7.2 **Disaster Supply Kit** - Always keep a disaster supply kit available which should include the following:
- Two-weeks supply of prescription medicines.
  - Two-weeks supply non-perishable/special dietary foods.
  - Drinking water in containers: 1 gal per person/per day for two weeks.
  - Flashlights and batteries for each member of the family.
  - Portable radio and (7 sets) batteries
  - First aid book and kit including bandages, antiseptic, tape, compresses, non-aspirin pain reliever, anti-diarrhea medication
  - Two coolers (one to keep food and one for ice).
  - Plastic wrap for roof/window repair, screening, tools, nails etc.
  - Water Purification kit (tablets, bleach, chlorine (plain) and iodine).
  - Infant necessities (medicine, sterile water, diapers, ready formula bottles)

***Note: For more information please contact the Department of Disaster Management.***

## Section 7: Disaster Preparedness

With the advent of the Internet, it is easy to find a host of written material concerning preparations for any emergency or disaster. In addition, there is plenty of literature concerning how to build homes that can better endure the impact of hazards such as hurricanes, earthquakes, flood etc. This section helps the homeowner to prepare for disasters that may affect his/her property.

In the strictest of terms, it is nearly impossible to build a home to withstand all types of disasters. Keep this in mind when deciding to ride out for instance a storm or hurricane in your home. You can however, plan to secure your property to better withstand the hazards that can affect your area.

### 7.1 Create a Disaster Plan

- A good disaster plan usually covers different kinds of events, such as hurricanes, earthquakes, floods etc.
- Review your insurance coverage; be aware if you have contents coverage, replacement value etc.
- Keep important telephone numbers with you.
- As a general rule, always keep your surroundings clean
- Keep a floor plan of your home easily available and mark out escape routes from each room.
- Make sure you know how to shut off gas, water and electricity at the main switches.
- Once you become aware of any impending disaster, or a watch or warning is issued arrange to have your property secured.
- Remember to monitor the radio and television for information being issued by the Department of Disaster Management

## Section 2: Selecting the Right

### 2.1 Why hire a Building Professional?

2.1.1 An Architect: is a professional who has achieved an acceptable level of knowledge in theory and practice to function in the field of architecture. American Institute of Architects (AIA) and the Royal Institute of British Architects (RIBA) are two of several organizations that register professionals via a licensing examination. Passing this examination indicates that the professional has obtained the education and experience to service the public .

Architects are trained to:

- Design a structure to respond to existing natural conditions
- Create options for building
- Maximize your construction dollar
- Increase your home's resale value
- Ensure that construction is carried out according to the plan, and
- Provide quality, professional services

2.1.2 An Engineer: In certain conditions an engineer may be required. Your General Contractor or yourself may feel there is something about the house or lot, which requires a stamp of approval from an engineer.

The success of a project is enhanced by the engagement of the best engineering expertise

- They bring experience from other related projects to your project
- They provide specialist expertise which you may not economically provide
- They can provide the manpower required to meet tight schedules
- They bring current knowledge of codes, standards, and procedures to your project
- They reduce life cycle costs of a project by optimizing design
- They can provide the full range of services from policy formula-

tion, concept development, pre-design, design, tender period services, construction administration, testing, commissioning, as well as operating/maintenance assistance

2.1.3 **A Land Surveyor:** is a professional who is licensed and is regulated by the British Virgin Islands Government, who, through a combination of education and experience, understands and is able to delineate the physical characteristics of land, and is also qualified to perform and depict a physical retracement of the legal history of that land. A Licensed Land Surveyor uses applied mathematics and other technical and research skills to measure and plot: the dimensions of any portion of the Earth's surface, natural and man-made structures, the lengths and directions of boundary lines, and the contour of the earth's surface.

Land Surveyors are also knowledgeable regarding zoning regulations, planning regulations, building codes, health codes, wetland regulations and general land use requirements. Land Surveyors may offer a variety of services including:

- Boundary Surveys
- Proposed Plot Plans
- Building Location and Foundation Location Surveys
- Topographic Surveys
- Subdivision Design and Planning
- Global Positioning System Surveys
- Geodetic Control Surveys
- Environmental Impact Statements
- Wetland Delineation and Location
- Mitigation Plans
- Land Development Plans
- Percolation Tests and Soil Descriptions
- Construction and Transportation Staking
- Monitoring of Structural Settling of Buildings and Other Structures

- Utility and Pipeline Surveys

Item to be checked	Monthly	Every 3 months	Every 6 months
<b>Interior</b>			
<b>Baths/Showers:</b> Check for evidence of any leaks, especially around toilets and under sinks (vinyl tile will usually discolor if water is getting underneath it). Check grout on any ceramic tile.			
<b>Kitchen:</b> Check for leaks under sink and around dishwasher. Check burner operation on stove. Check grout on any ceramic tile.			
<b>Kitchen:</b> Clean dust from refrigerator con-			
<b>Water Heater:</b> Check for signs of leaks and drain to remove any sediment. In areas with hard water, drain every 3 months.			
<b>Smoke Detectors:</b> Check operation,			
<b>Fire Extinguishers:</b> Check for replac-			
<b>Basement or crawl space:</b> Check for cracks or any sign of dampness or leaks. Check for any evidence of termites or wood eating insects.			

**6.3 Maintenance Checklist for Current Homeowners**

Item to be checked	Monthly	Every 3 months	Every 6 months
<b>Exterior</b>			
<b>Roof:</b> Visually check shingles or other from ground. Watch for missing shingles or broken pieces. Check gutters and downspouts.			
<b>Gutters and downspouts:</b> Check and remove any debris to assure unobstructed water flow away from foundation.			
<b>Veneer or siding:</b> With wood, watch for deteriorating roof or masonry cracks. For siding, watch for warping or rot. Check all painted surfaces.			
<b>Windows, doors and shutters:</b> Check caulking around doors and windows,			
<b>Lawn and garden:</b> Watch for accumulation of tree limbs, branches, debris that can attract wood eating insects.			
<b>Driveways:</b> Check for cracks or deterioration. Reseal if necessary.			
<b>Air Condition Units:</b> Make sure outside unit is unobstructed. Clean unit with gar-			

2.1.4 **A Building Contractor:** is a contractor whose principal contracting business is in connection with any structure built, being built, or to be built.

A building contractor may perform the following tasks:

- Examine and interpret clients' plans or arrange the drawing of plans to meet building regulations
- Submit tenders (offers to do jobs at a stated price), quotes or prices for the project to clients
- Arrange submission of plans to local authorities for approval and arrange inspections of building work
- Organize subcontractors to carry out all stages of building and negotiate rates of pay
- Calculate quantities of material required for building projects and order these from building suppliers or advertise for tenders
- Arrange delivery times of materials to coincide with various stages of the building process
- Supervise the work of subcontractors to make sure buildings are of an acceptable standard and are proceeding according to schedule
- Coordinate the activities of office staff involved in the preparation and payment of accounts

Talk to lawyers and financial institutions on matters relating to loans and contracts for building projects

Undertake some of the building work personally.

2.1.5 **A Plumbing Contractor:** is a professional contractor that

*"It's better to prepare and prevent rather than repair and repent" – S.Thomas 1856*

Keep these points in mind when you remove trees and potential windborne missiles from around your house:

- ✓ Removing large trees near your house can be extremely dangerous, for both you and your house, and therefore is a job for a skilled contractor.
- ✓ The straps and ground anchors used for manufactured homes also can be used to anchor outbuildings, especially small garden sheds, which are usually not placed on a permanent foundation.
- ✓ You can secure outdoor furniture and barbecue grills by bolting them to decks or patios or by attaching them to ground anchors with cables or chains.
- ✓ You can secure trash cans with cables or chains attached to ground anchors or to wood posts firmly embedded in the ground. Trashcan lids should be tied to cans with cables or chains.



#### **Builders Reminder**

- *It is important to ensure that an adequate maintenance programme is in place.*
- *The annual maintenance budget for a building should be of the order of four percent of the current value of the building*

*"It's better to prepare and prevent rather than repair and repent" – S.Thomas 1856*

- Class D fires involve combustible metals.

A typical home of office fire extinguisher should have an ABC rating.

## 6.2 Keep your property clear of debris and potential wind-borne missiles.

If the area immediately surrounding your house contains trees, outbuildings, trashcans, yard debris, or other materials that can be moved by the wind, your house will be more likely to be damaged during a hurricane. The wind can topple trees onto your house and can pick up smaller objects and drive them through windows and glass doors.

You should ensure that all trees are far enough away from your house that they can't fall on it.

So the distance between your house and any nearby tree should always be greater than the height the tree will reach when it is fully grown. All storage sheds and other outbuildings should be securely anchored, either to a permanent foundation or with straps and ground anchors. Smaller objects, such as trashcans, barbecue grills, and outdoor furniture should also be anchored or, if you have adequate warning, moved indoors. You should also clear away any debris, such as fallen tree branches.

provides a means for a supply of safe water, ample in volume and of suitable temperature for the purpose intended and the proper disposal of fluid waste from the premises in all structures and fixed works. This classification includes but is not limited to:

Complete removal of waste from the premises or the construction and connection of on-site waste disposal systems;

Piping, storage tanks and venting for a safe and adequate supply of gases and liquids for any purpose.

All gas appliances and gas connections for all systems.

Water and gas piping from the property owner's side of the utility meter to the structure or fixed works; Installation of any type of equipment to heat water, or fluids, including the installation of solar equipment.

- The maintenance and replacement of all items described above.

2.1.6 An Electrical Contractor: places, installs, erects or connects any electrical wires, fixtures, appliances, apparatus, raceways, conduits, solar photovoltaic cells or any part hereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose.

cause almost all fires are small at first, they might be contained if a fire extinguisher is handy and used properly. You should take care, however, to select the right kind of fire extinguisher, because there are different ones for different kinds of fires. Install fire extinguishers on every level of the home and include the kitchen, basement and garage.

### Selecting a Fire Extinguisher

Extinguishers are classified according to the class of fire for which they are suitable. The four classes of fires are A, B, C, and D:

- Class A fires involve common combustibles such as wood, paper, cloth, rubber, trash and plastics. They are common in typical commercial and home settings.
- Class B fires involve flammable liquids, solvents, oil, gasoline, paints, lacquers and other oil-based products. Class B fires often spread rapidly. Unless they are properly suppressed, they can re-flash after the flames have been extinguished.
- Class C fires involve energized equipment such as wiring, controls, motors, machinery or appliances. They can be caused by a spark, a power surge, or a short circuit and typically occur in locations that may be difficult to see or reach.



paired. Unplug appliances when not in use. Use safety caps to cover all unused outlets, especially if there are small children in the home.

### **Affordable Home Fire Safety Sprinklers**

When home fire sprinklers are used with working smoke alarms, your chances of surviving a fire are greatly increased. Sprinklers are affordable - they can increase property value and lower insurance rates.

### **Plan Your Escape**

Practice an escape plan from every room in the house. Caution everyone to stay low to the floor when escaping from fire and never to open doors that are hot. Select a location where everyone can meet after escaping the house. Get out then call for help.

### **Caring for Children & Older People**

Children under five are naturally curious about fire. Many play with matches and lighters. Take the mystery out of fire play by teaching your children that fire is a tool, not a toy. Senior citizens death in fires can be prevented. Seniors are especially vulnerable because many live alone and can't respond quickly.

### **Fire Extinguishers**

To guard against small fires or to keep a small fire from developing into a big one, every home should be equipped with fire extinguisher. Be-

## **Section 3: The Building Design Process**

### **3.1 Before designing your building it is necessary to...**

3.1.1 Make site visits to acquaint the Architect and you the homeowner with what is possible. Visits to the site should be made as often as necessary to eliminate surprises during the course of the project. After site surveying, a certified surveyor produces a drawing. Contours, existing elements like trees, boulders, ghuts, should be located so the Architect can know what there is to work with. The sun's passage through the sky should be documented for a better understanding of the structure's fenestration (openings for light), shade and shadow. Wind currents should be noted for ventilation purposes.

3.1.2 Ensure that the structure is designed with the natural environment in mind the potential as well as the obvious. During site visits, an earth tremor may never happen, however, the structure of the house should take this possibility into consideration in its structural design. All of the impacts your site will have on your structure and how the structure will impact the site should be known during the design phase of the project.

3.1.3 Consider climate-specific design. This saves you money by incorporating the prevailing wind patterns and sun angles to maintain a comfortable temperature within the home. The materials used on the various sides of the building, depending on where they face, would not perform the same way.

The east side of a structure is exposed to a higher arching sun. Shade devices on this side should be vertical. The west side of a structure is exposed to a lower sun angle that projects sunlight and heat almost vertically into a

building. Shade devices on this side would be horizontal.

It would be advisable to thicken the wall facing west or use a low insulating material to diminish heat gain that is transferred into the interior.

Other climate-specific design issues to consider are rainfall and wind direction. Designing a house without taking into consideration how to prevent rain runoff from eroding a foundation or orienting windows to allow dust and other airborne products to enter a building are unprofessional solutions to a site problem.

### 6.1.2.1 Tips to make your home safe from fires

An overwhelming number of fires occur in the home. There are time-tested ways to prevent and survive a fire. It's not a question of luck. It's a matter of planning ahead.

#### **Every Home Should Have at Least One Working Smoke Alarm**

Buy a smoke alarm at any hardware or discount store. It's inexpensive protection for you and your family. Install a smoke alarm on every level of your home. A working smoke alarm can double your chances of survival. Test it monthly, keep it free of dust and replace the battery at least once a year.

Smoke alarms themselves should be replaced after ten years of service, or as recommended by the manufacturer.

#### **Prevent Electrical Fires**

Never overload circuits or extension cords. Do not place cords and wires under rugs, over nails or in high traffic areas. Immediately shut off and unplug appliances that sputter, spark or emit an unusual smell. Have them professionally repaired or replaced.

#### **Use Appliances Wisely**

When using appliances follow the manufacturer's safety precautions. Overheating, unusual smells, shorts and sparks are all warning signs that appliances need to be shut off, then replaced or re-

## 6.1.2 Insurance Issues

### Why insure your home.

There are two main reasons for insuring your home.

- If a Bank has a mortgage on the property, the bank will only authorize a loan if full replacement cost insurance is in place.
- The average home in the BVI is valued at \$330,000 and for most homeowners it is their main investment and insurance protects this investment.

### Insurance Companies will allow premium credits for the following:

- Concrete roof
- Fire alarm systems
- Hurricane Shutters

### Homeowner relationship with the insurer

To achieve the best relationship with the insurer, the owner should discuss insurance coverage and related matters with the insurer during the initial planning stages of the project.

### The role of the Insurer

The role of the insurer is to provide protection to the owner by providing coverage for damage and/or losses from perils, including natural hazards.

## 3.2 Know what hazards can affect your property:

**Hurricane - protection can involve a variety of changes to your house and property...changes that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in the BVI. One example of hurricane protection is clearing the area around your house to remove trees and materials that can be hazardous during high winds. Removing debris and small trees are things that many homeowners can probably do on their own.**

**Hurricanes and tropical storms are cyclones with tropical origins (tropical cyclones). Tropical storm winds are 39 to 73 miles per hour; hurricanes have wind speeds of 74 miles per hour or more. Hurricane winds blow in a large spiral around a relatively calm center known as the "eye." The "eye" is generally 20 to 30 miles wide, and the storm may have a diameter of 400 miles across. As a hurricane approaches, the skies will begin to darken and winds will grow in strength. A hurricane can bring torrential rains, high winds, and storm surge as it nears land. A single hurricane can last more than two weeks over open waters and can run a path across the entire length of the eastern seaboard.**

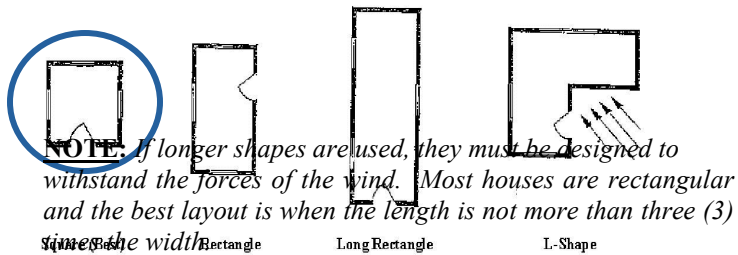
**A storm surge is a dome of ocean water that can be 20 feet high at its peak and 50 to 100 miles wide and can be more dangerous than a hurricane. The surge can devastate coastal communities as it sweeps ashore.**

### 3.2.1.1 Hurricane Resistant Design

**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



Best Design

**External Areas**

- √ Flooding often follows a hurricane. Check to see how high the water reached in previous heavy rainstorms and ensure that drains are cleared to carry the rainwater away from the building, and that no storm water can get into the building.



structure on the adjacent property

### **The building**

- √ Proper state of repair for all exterior surfaces of the structure with downspout and properly channel water to a cistern or other receptacle to eliminate deterioration of surrounding surfaces posing a hazard.
- √ Every exterior opening must be fitted with a window, door or basement hatchway cover, which should be tight, and also in good repair.

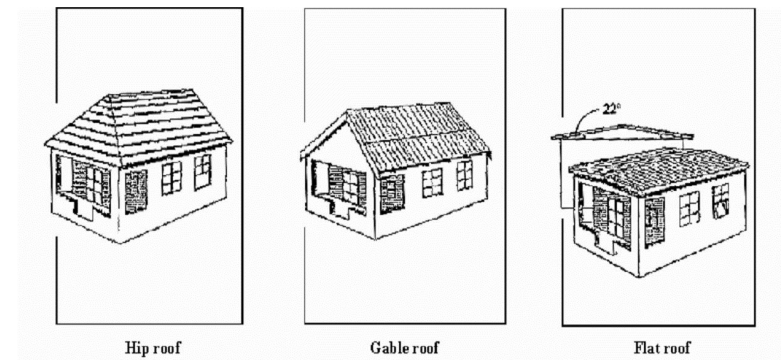
### **Roofs**


- √ Replace all corroded roof sheets. Examine the purlins and rafters and replace the rotten ones. Make sure that the drive screws are driven into solid material and cannot be pulled out easily.
- √ Make sure that the ridge cap is solidly fixed to the roof sheet and that the wind cannot peel the ridge cap off.
- √ Check the wall plate to be sure that it is not rotten. If it is, replace it and secure the plate to the wall by bolts.

### **Doors and Windows**

- √ Examine the doors and windows. They should close tightly.
- √ Ensure that the operators on louvered windows are all working.
- √ Replace all broken glass in windows.

- **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. (*See section 5.3.2, pages 63 to 69 for detailed hurricane resistant roof construction*).

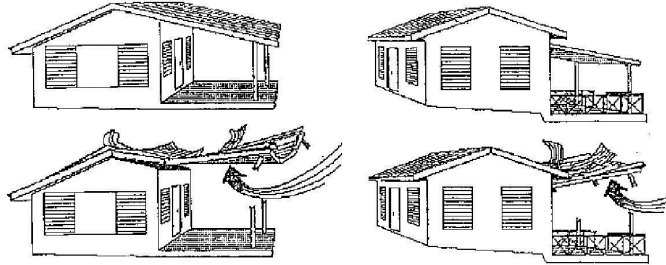




### **Builders Reminders**

- Avoid a low-pitched roof; use a hip roof or a high-pitched gable roof.
- Avoid overhanging roofs. If overhangs or canopies are desired, they should be separated from the main roof structures.
- Avoid openings, which cannot be securely closed during a hurricane. Where openings are already in existence, hurricane shutters should be provided.
- 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 forces 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.

- **Consider Shutters**

Shutters seem to be considered an unattractive feature, and are not an apparent priority to homeowners, but their importance should not be overlooked as the glass doors and windows offer very little resistance to high winds.

The use of temporary shutters is a viable option over permanent ones, but can create a storage problem when they are not in use.

## Section 6: Maintaining Your Building

### 6.1 Maintenance

#### 6.1.1 Maintenance of your building and property

If a good system for maintenance is not properly organized, funded, staffed and carried out, then all other disaster mitigation efforts could prove insufficient. Moreover, experience indicates that roofs, walls, and equipment in general are more vulnerable to failure if normally operated at near break down, or at any level of technical deficiency.

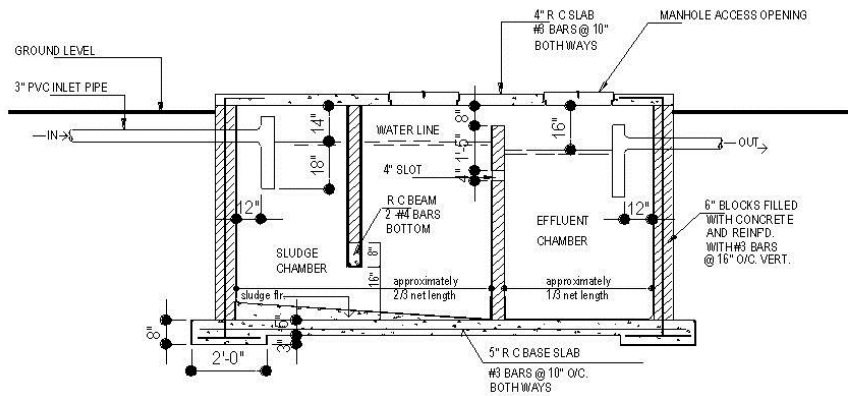
While a properly designed and maintained building would be resistant to natural hazards, experience has shown that some additional precautions may have to be taken to secure the facility and allow it to function during and immediately after such events. The principal areas to be examined for maintaining disaster resistance of a facility and the corrective measures to be taken are indicated below:

##### 6.1.1.1 What to look for?

***The property:***

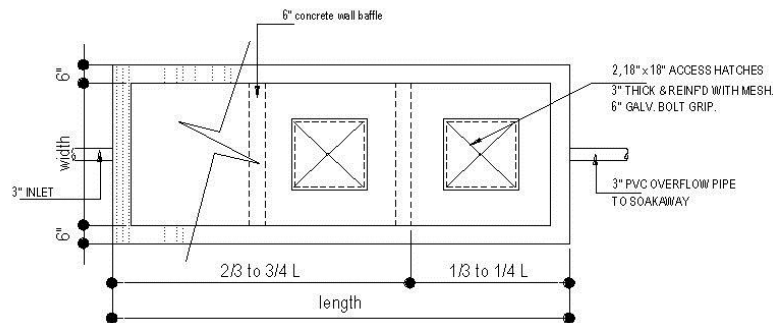
- √ Maintained driveways with approved surface paving that directs runoff onto property
- √ Structurally sound fences and retaining walls
- √ All shrubbery must be neatly trimmed and maintained at all times. No limbs from trees should be allowed to grow onto adjacent property below the height of 10', or to touch any

Clay soil or coral should be removed from a proposed soak away field and replaced with a porous material that allows percolation. The method of effluent distribution and the gallons of sewage per person determines the required land area for a soak away field



SEPTIC TANK SPECIFICATIONS-CROSS SECTION

SCALE: NTS



SEPTIC TANK SPECIFICATIONS- PLAN LAYOUT

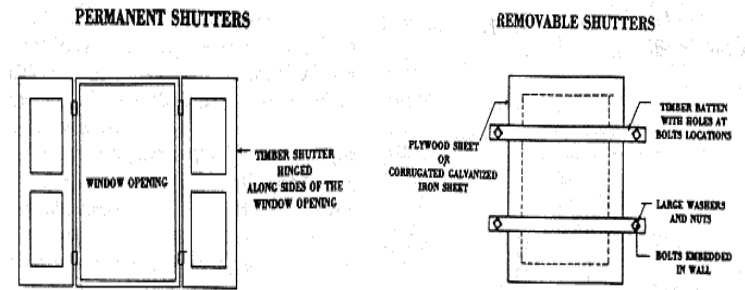


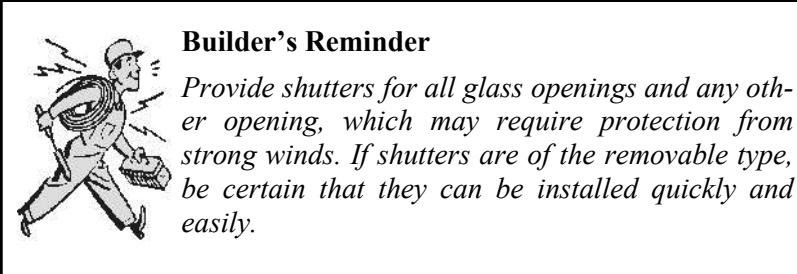
Figure 3.1: Permanent Shutters

Figure 3.2: Removable Shutter

Hurricane shutters and other window protection available in the BVI:

- ◆ Shutters: Accordion, Rolldown, Colonial and Bahama.
- ◆ Panels: Storm and Lexan
- ◆ Windows and Screens: Impact Windows, Integral System Windows and Storm Screens.

**Note:** The loss of a glass door or window will increase the pressure inside of the house and this pressure will cause failure of the roof structure. Bearing this in mind, both new and existing houses should have permanent shutters installed or provision for temporary ones should be made.



- 3.2.2 Earthquake—An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy.



When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates.



Ground shaking from earthquakes can collapse buildings and bridges; electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean

**Clay** is plastic and holds water, it will not allow it to percolate.

### **Coral**

The soakaway rock is a white porous coral that is found on beaches. The area around the septic tank is filled with these rocks increasing the porosity.

Coral's availability is limited. This material has a high pH; when soaked with acidic material (septic waste) the coral disintegrates.

The breakdown continues over time and leads to sinking around the tank. More dirt is thrown on top of the sinking grade to level it again; depending on the contents, the porosity may be reduced.



surface water pollution, and disease outbreaks can occur. Therefore, it makes good sense to understand and care for your septic tank system. There are many different types of septic tank systems to fit a wide range of soil and site conditions. The following information will help you to understand a conventional gravity-flow septic tank system, and keep it operating safely at the lowest possible cost. A conventional gravity-flow septic tank system has three working parts:

1. The septic tank.
2. The drain field with its replacement area.
3. The surrounding soil

Figure 5.30 - Image showing extent of septic tank and soak away field system

waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths and injuries and extensive property damage.

Most earthquake-related injuries result from collapsing walls, flying glass, and falling objects as a result of the ground shaking, or people trying to move more than a few feet during the shaking. Much of the damage in earthquakes is predictable and preventable.

### Earthquake Resistant Design

- **Soil Type and Condition:** Bearing capacity is a factor. The BVI does not have a soils map; it may be determined by how other structures survived within the area. This affects the type and depth of footing that is designed.
- **Building shape:** Reasonably proportioned rectangular shapes, rather than long narrow buildings are best suited. Interior cross walls help brace exterior walls against lateral forces
- **Openings:** Openings too close to corners weakens them. Maintain a distance of 25% of the height of the wall from the corner, or a minimum distance of 1'-3".

Total length of opening should be up to half the length of the wall between consecutive cross walls.

The horizontal distance between two openings should be at least one half the height of the shorter opening.

For two storey buildings, the vertical distance from an opening to one directly above it should be at least two feet, or at least one half the width of the smaller opening.

### 3.2.3

Fires – Fire in a home is a major hazard that all homeowners should be aware of. Early detection is the key to protecting your



family and keeping damage to a minimum. Ensure your home has smoke detectors, well-insulated electrical cords, covered weather proof exterior outlets, fire extinguishers purchased for the specific area of use (kitchen or cooking areas, bedrooms, offices). It is a good idea to keep trees and other flora near the house trimmed to diminish their ability to transfer a fire to the home and to avoid limbs from falling in a tropical storm. Knowledge of your home's electrical system is also valuable in case you have to turn off all power in case of an emergency, such as a fire. You should know the location of the main electric switch in the house and how to use it. You should also know the location of the fuse box or circuit breaker and how to reset a breaker or replace a fuse in case one blows.

- Repair dripping faucets by replacing washers. If your faucet is dripping at the rate of one drop per second, you can expect to waste 2,700 gallons per year which will add to the cost of water and sewer utilities, or strain your septic system.
- Check for toilet tank leaks by adding food coloring to the tank. If the toilet is leaking, color will appear in the toilet bowl within 30 minutes. Check the toilet for worn out, corroded or bent parts. Most replacement parts are inexpensive, readily available and easily installed. (Flush as soon as test is done, since food coloring may stain tank.)
- Avoid flushing the toilet unnecessarily. Dispose of tissues, insects and other such waste in the trash rather than the toilet

### 5.3.6.3

#### Telephone

When you are planning a building project or even renovating existing commercial or residential property, you can take advantage of the free consultancy service provided by Cable & Wireless.

Cable & Wireless offer advice on cable entry, ducting and wire protection to ensure that your building is designed to cater for all your future telecommunications needs

To learn more about this service, call **494-4444, ext. 823** and speak to their Property/Building Liaison Officer.

### 5.3.6.4

Proper Waste Disposal - Households depend on septic tank systems to treat and dispose of waste water. A well designed, installed, and maintained septic system can provide years of reliable low-cost service. When these systems fail to operate effectively, property damage, groundwater and

- Treatment is administrated according to the volume of water in the cistern at the time of treatment; therefore the dimensions of the cistern must be attained along with the liquid depth of water in the cistern.
- Water shouldn't be used until 12 hours after chlorine has been administered

### How to obtain potable water

Make application on the prescribed forms, which are available at the Water and Sewerage Department offices in Baugher's Bay. Virgin Gorda and Jost Van Dyke.

### Where should your water meter be located on site?

The Meter is the property of the Water and Sewerage Department and should be located at the boundary line of your property.

### How to maintain Septic Tanks and Sewer System

Clean septic tank every three to four years.

### Water conservation measures that can be implemented in your homes.

- Wash vehicles with bucket of water instead of a hose
- Use a watering can to wet plants instead of a hose.
- Turn off faucets when soaping dishes, brushing teeth, and soaping in the shower.
- Put water saving devices on fixtures.
- Never put water down the drain when there may be another use for it such as watering a plant or garden, or cleaning.
- Verify that your home is leak-free, because many homes have hidden water leaks. Read your water meter before and after a two-hour period when no water is being used. If the meter does not read exactly the same, there is a leak.

3.2.3.1 Fire resistant design - While the area around the home is important, the construction of the home itself also is significant here are some fundamentals:

- Make sure the roof material is rated for fire resistance. The roof is a critical area due to its surface area and tendency to accumulate blowing cinders.
- Buy fire-resistant materials or treat existing ones with fire-retardants.
- Hang shutters outdoors or fire-resistant drapery indoors.
- Cover open areas in the foundation and eaves with metal screen.
- Choose a building site away from the top of a ridge.
- Keep LP tanks at least 30' away from the house. LP tanks should also be located at the same level as the home if possible.

3.2.3.2 Fire resistant landscape design - Your top priority outdoors is creating a **defensible space** around the house or other structures. Defensible space is the term used to define an area around the house where flammable material has been removed or reduced. This area serves as a fuel break and buffer zone. The goal is to keep a fire moving slow and low until it can be extinguished.

The space serves two purposes in the event of wildfire - to slow the fire down and give firefighters a space to concentrate on saving the house itself.

The minimum defensible space around a home is 30 feet. This area has little or no vegetation. As alternatives, walkways and stone walls can help dress up the landscape.

A second zone extending an additional 75 feet is also recommended. This area has more vegetation, but still follows firewise guidelines.

The secondary zone needs to be larger if the home is on top of a slope - up to 100 feet is advisable.

If these defensible space dimensions exceed your property lines, make every effort to get your neighboring property owners involved in making the area firewise.

The key steps to a fire-safe landscape include:

- Clear or trim vegetation from around the house that might encourage fire or allow fire to "leapfrog" to another spot. Foundation plantings especially need to be addressed.
- Choose fire resistant plants for the landscape.
- Keep the area raked. Leaves are perfect fuel for fires. Remove duff. Duff is a layer of decomposing organic matter that lies below freshly fallen leaves and above the soil. Duff can ignite and smolder unnoticed.
- Decrease the number of trees in heavily wooded areas. Thin existing trees to 10' apart at crowns. Keep the ground below trees free of debris.
- Any new tree or shrub plantings should be at least 10' - 15' apart. Remember to use the mature width

### **To avoid Fire Hazards:**

- Before refueling the generator, turn it off and let it cool. Fuel spilled on hot engine parts could ignite.
- Always store fuel outside of living areas in properly labeled, non-glass containers.
- Store fuel away from any fuel-burning appliance.

#### 5.3.6.2 Water Safety

##### **The Safest way to store water in your Cistern**

- Clean guttering of rotting leaves and other organic matter regularly.
- Clean or replace fitter on inlet pipeline in accordance with manufacturer's recommendations.
- On a quarterly basis take sample of water to the Water and Sewerage Department for analysis. Refer the result to the Environment Health Division and follow their recommendations (Analysis fee - \$25.00)

##### **The Safest way to treat water in your Cistern**

- Verify whether or not the water is actually contaminated by having it tested at the Water Sewerage Department
- If treatment is required have them fax the results to the Environmental Health Division and contact the department to make the necessary arrangements.
- Water will be treated according to World Health Organization (WHO) standards using Sodium Hypochlorite (Granular Chlorine).

**To avoid Carbon Monoxide Hazards:**

- Always use generators outdoors, away from doors, windows and vents.
- NEVER use generators in homes, garages, basements, crawl spaces, or other enclosed or partially enclosed areas, even with ventilation.
- Follow manufacturer's instructions.
- Install battery-operated or plug-in (with battery backup) carbon monoxide (CO) alarms in your home, following manufacturer's instructions.
- Test CO alarms often and replace batteries when needed.

**To avoid Electrical Hazards:**

- Keep the generator dry. Operate on a dry surface under an open, canopy- like structure.
- Dry your hands before touching the generator.
- Plug appliances directly into generator or use a heavy-duty outdoor- rated extension cord. Make sure entire extension cord is free of cuts or tears and the plug has all 3 prongs, especially a grounding pin.
- NEVER plug the generator into a wall outlet. This practice, known as back feeding, can cause an electrocution risk to utility workers and others served by the same utility transformer.
- If necessary to connect generator to house wiring to power appliances, have a qualified electrician install appropriate equipment. Or, your utility company may be able to install an appropriate transfer switch.

when calculating the planting space.

- Plant in smaller beds. They are safer than large massed plantings. Space taller plants further apart than shorter ones.
- Don't plant trees underneath electrical lines. Have the power company keep limbs clear of power lines.
- Keep dead or diseased trees and shrubs pruned or removed.
- Don't pile brush. Chip it and use in compost or remove it for disposal.
- Use rock and stepping stones for landscape features instead of plants, especially within the defensible space.
- Diversify plant selections. This reduces the chance of pests and diseases. Healthy plants are more fire-resistant.
- Mow regularly. Grasses should be no taller than 8".
- Irrigate plants as well as your water situation allows.
- Avoid shrubs, trees and mulches with a high resin content

Avoid ladder fuels. These plants create a ladder for the fire to climb onto the roof of this home.

- Clean debris from gutters and roof. Leaves on the roof and in the gutters provide tinder for blowing sparks.
- Use thin layers of mulch; enough to suppress weeds but not enough to smolder for hours.

- Avoid **ladder fuels**. These are subsequent plantings of grass and groundcovers, shrubs and then trees. This style of planting allows fire to move up to the treetops.
- Maintain all plants by regularly removing dead branches and leaves

3.2.4 Flooding - occurs in known floodplains when prolonged rainfall over several days of intense rainfall over a short period of time, floods the surrounding area. Tropical cyclones can bring intense rainfall as well.

Flash floods can occur as early as within six hours of a rain event, or after a gully or drain overflows due to blockage, or when the sea backflows. Flash floods can catch people unprepared. You will not always have a warning that sudden floods are coming.

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization, or increasing nonporous paving materials, increases runoff two to six times over what would occur on natural terrain. During periods of urban flooding, streets can become swift moving rivers.

Several factors contribute to flooding: **rainfall intensity and duration**. Intensity is the rate of rainfall, and duration is how long the rain lasts.

- The certificate indicates that the project has passed inspection.

### Alternative sources of power

From time to time, owners may desire to install emergency generators on their premises. In order to do this, they must first request permission from the Minister of Communication and Works. This permission will be granted once they adhere to the following guidelines:

- The installation must have an automatic or manual change over switch to ensure that it will never run in parallel with the BVI Electricity Corporation supply system.
- A licensed electrician must carry out the installation
- The Government's Electrical Inspector must inspect the system.
- Any alterations or additions after inspection must be reported to the BVIEC immediately
- The generator should only be used when the public supply is not available or for occasional testing of the unit. We recommended a test period of 2 hours per week.

Portable generators are useful when temporary or remote electric power is needed, but they can be hazardous. The primary hazards to avoid when using them are carbon monoxide poisoning, electric shock or electrocution, and fire.

1. Climb onto porches or into basements
2. Traverse boundaries and enclosed fences if property is fenced, meters should be at the edge of the fence.
3. Fend off dogs that are tied to the meter areas
4. Locate home owners in order to gain access to the Corporation's property
5. Cut through trees and shrubs to locate meters
6. Do not do anything that would slow down or restrict the Corporation workers from efficiently performing their duties

### Safety

It is the duty of the owners of any building project to ensure that qualified electrical contractors are the ones that is responsible for all of the work. This further reinforced by the Government's Electrical Inspection Division. It is their sole duty to regulate the electrical building trades, inspect all new and rewiring projects and issue a certificate of approval.

The certificate states that the work has passed and the official inspection is ready to be connected unto the corporation's system. The corporation will not connect any meter to the system until the following is done.

- An estimate of the cost for the works has been performed
- The cost of the work has been paid or arrangements made to do the same
- A certificate of inspection has been deposited to the Corporation



Topography, soil conditions, and ground cover also play important roles. Most flash flooding is caused by slow-moving thunderstorms, thunderstorms repeatedly moving over the same area, or heavy rains from hurricanes and tropical storms. Floods, on the other hand, can be slow-

or fast rising, but generally develop over a period of hours or days.

Know if a structure will be susceptible to flooding on your site. Your architect should be able to assist you. Elevate the first floor slab above finished grade.

Redirect runoff into ponds on the property or places where the water can be absorbed by the ground. Swales are created to direct runoff to specific areas.

3.2.4.1 Flood resistant design - If you aren't sure whether your house is at risk from flooding, check with Town & Country Planning Department or the Department of Disaster Management. They can tell you whether you are in a flood hazard area. Also, they usually can tell you how to protect yourself and your house and property from flooding.

In the BVI special consideration must be given by home design professionals where houses are situated near ghuts, ponds and in flood prone areas in locating sewer systems and cisterns on the property site.

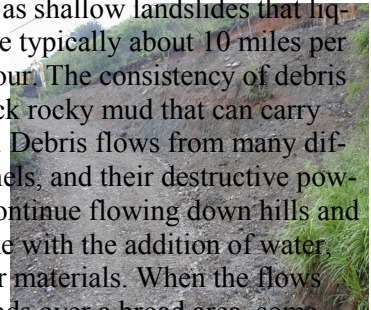
**3.2.5 Landslide** - Some land slides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth materials to landslide movement include:

- saturation by water,
- steepening of slopes by erosion or construction, and
- earthquake activity.

**Landslides are associated with heavy rainfall and tend to**

worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides

They usually start on steep hillsides as shallow landslides that liquefy and accelerate to speeds that are typically about 10 miles per hour, but can exceed 35 miles per hour. The consistency of debris flows range from watery mud to thick rocky mud that can carry large items boulders, trees, and cars. Debris flows from many different sources can combine in channels, and their destructive power may be greatly increased. They continue flowing down hills and through channels, growing in volume with the addition of water, sand, mud, boulders, trees, and other materials. When the flows reach flatter ground, the debris spreads over a broad area, sometimes accumulating in thick deposits that can cause greater problems in developed areas.



**3.2.5.1 Landslide Resistant Design - Contact the Town & Country Planning Department or the Department of Disaster Management on areas vulnerable to landsliding. Consult a professional geotechnical expert for opinions and advice on landslide problems and on corrective measures you can take.**

Minimize home hazards:

*“It’s better to prepare and prevent rather than repair and repent” – S.Thomas 1856*

**5.3.6 Utilities**

**5.3.6.1 Electricity**

- BVI Electricity Installation Guidelines

The BVI Electricity Corporation follows the BVIEC Ordinance of 1978 and the subsequent regulations, which was gazette in 1985. The Electricity supply as pertains to residential, apartment and commercial buildings and industrials sites will have the following specifications:

- Distribution voltage 13,200v 3 phrase – 60 hertz
- Low Voltage Distribution
  1. 3 phase – 60Hz – 120/208 volts – 4 wire (earthed neutral)
  2. Single (2) phase – 3 wire (neutral earthed) – 120/240 volts, 60Hz
  3. Single (1) phase – 2 wire (neutral earthed) – 120v, 60 Hz

The voltage may be subject to a variation of +/- 2.5% of the declared frequency.

The BVIEC’s authority extends up to the meter location and as such the following guidelines are to be adhered to before such meter installation can occur.

**Accessibility**

The chosen location must be accessible by employees of the corporation without having to:

*“It’s better to prepare and prevent rather than repair and repent” – S.Thomas 1856*



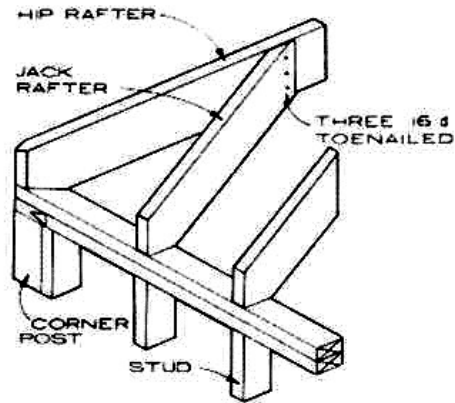


Figure 5.30 Jack Rafter

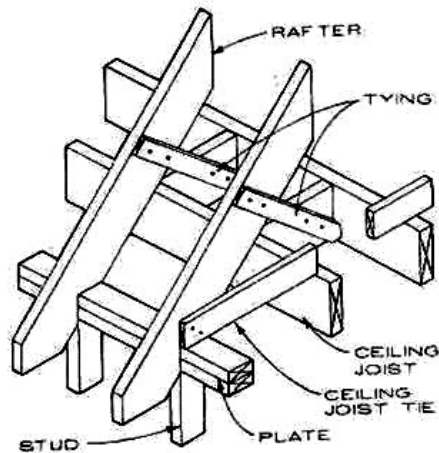


Figure 5.31 Bracing of Roof Rafters are at Rt. Angles to Joists

**Note:** Please Refer to the Virgin Islands Building Reg. 1999, Timber Connection Part XII, No. 265 (I) and No. 266 (I)

Plant ground cover on slopes and build retaining walls. In mudflow areas, build channels or deflection walls to direct the flow around buildings. Remember: If you build walls to divert debris flow and the flow lands on a neighbour's property, you may be liable for damages.

### How to Protect Your Property

If your property is in a landslide-prone area, contact a private consulting company specializing in earth movement for opinions and advice on landslide problems and on corrective measures you can take. Such companies would likely be those specializing in geotechnical engineering, structural engineering, or civil engineering. Local officials could possibly advise you as to the best kind of professional to contact. Taking steps without consulting a professional could make your situation worse.

Install flexible pipe fittings to avoid gas or water leaks. Flexible fittings will be less likely to break.

### 3.3 See your building before the construction phase -

Up to this point, your building should have been designed to avoid any change orders during construction that would adversely affect the bottom line. All of the spaces, their sizes and relationships should be understood and accepted prior to construction

- In Timber buildings, post foundation, roofs and walls must be braced in each direction.

Figure 5.28 Corner Post

**Note:** *Minimum three studs per corner and strap at out side corner at third points.*

Figure 5.29 Top Plate & Bracing

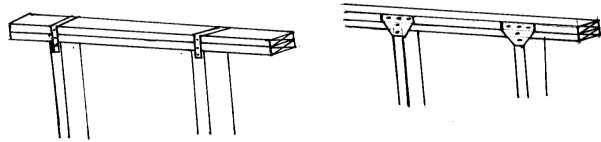


Figure 5.26 Wall plate straps

- 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.

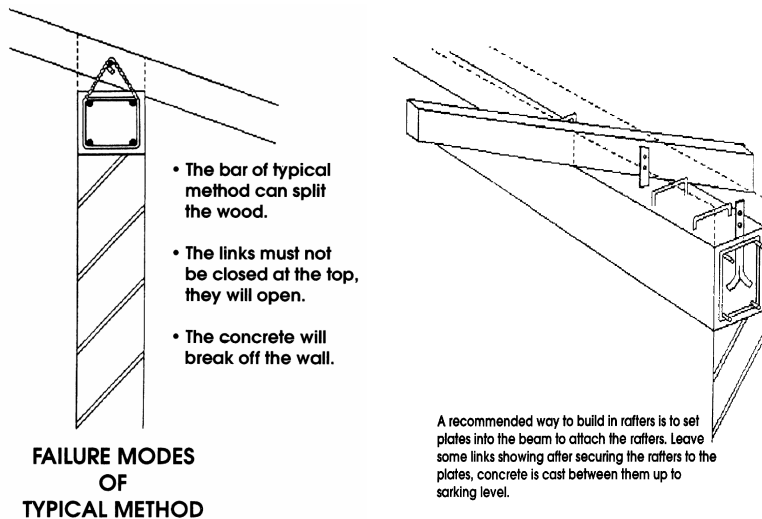


Figure 5.27 Failure modes and recommended ways to build rafters

## Section 4: Preparing the Site

**4.1 Site preparation:** occurs before any construction work begins. The site is organized so that the construction process flows smoothly and natural occurrences- rain, wind, etc. – impact the least on the construction phase schedule.

### Checklist for Site Conditions

- General topography assessment and potential hazards  
The topography will show how storm water flows, how to control it, and where the best place, or places are, to contain it without it migrating to adjoining properties.  
Land slippage will be evident. Analyse site to construct solutions.
  - Determine wind direction
- Determine transportation access to the site
- Existing public utility lines interference with proposed development should be considered
- Determine whether utilities exists or whether new installation is required.
  - Consider the Flora; the general area of the structure should be determined and evaluated to identify what trees are to be removed. Evaluate what effect removing the trees would have on the overall natural element activity of the site. As many trees as possible should be preserved.
  - Look for evidence of vermin infestation
  - Check locations for
    - Access road within property
    - Stockpiling construction materials
    - Containing runoff (silt fences, if necessary)

**4.2 Find out if you need an Environmental Impact**

### Assessment (EIA):

Environmental Impact Assessments are requested for areas deemed sensitive to development. It may be requested for:

1. Large scale residential developments;
2. Medium and large commercial projects;
- Mining operations;
- Manufacturing developments;
- Private energy reserves such as oil on outer islands;
6. Any kind of development in environmentally sensitive area, and
7. Developments near any bodies of water.

An EIA should include:

1. Detailed project description;
2. Site history;
3. Current and historical land use;
4. Description of the site and the environment;
5. Physical terrestrial characteristics;
- Review of prior baseline data for the site;
7. The marine environment's characteristics and elements where appropriate;
8. Identification of possible impacts including impacts on coastal and marine resources;
9. Listing of all stakeholders and affected parties who will be contacted to the extent possible;
10. Mitigating alternatives to minimize unavoidable adverse impacts during and after the construction phase;
11. Longer-range likely impacts of proposed site activities;
- Subsequent long-term monitoring measures;
- Specified limits of change (i.e., inclusions) for future development for the site;
- Identification of all adjacent or nearby environmentally sensitive or historically/culturally significant areas and development of an

*"It's better to prepare and prevent rather than repair and repent" – S.Thomas 1856*

- Twisted straps should be 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.

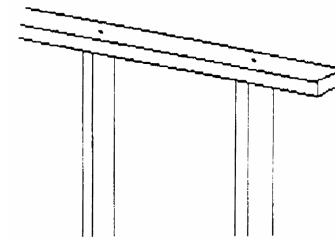


Figure 5.24 - They are often insecurely held down by nails into the end grain of posts.

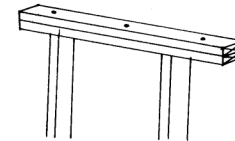


Figure 5.25 - If a double plate is used, notch and nail the lower one and secure the top one well.

*"It's better to prepare and prevent rather than repair and repent" – S.Thomas 1856*



Figure 5. 22 Different 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 on existing roofs to strengthen them

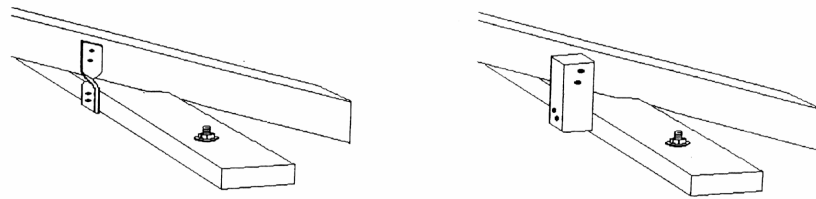


Figure 5.23 Timber Connectors

impact and mitigation strategy to protect the affected from harm;

**Summary and recommendation**

14. Images that document the existing environment and that support the development

### 4.3 What are the site characteristics you should look for?

These are observed when one visits the site often during different weather conditions: sunny, cloudy, rainy, windy, etc. One has information of the contours, existing trees, and natural formations. Conduct the following:

- Proximity to Hazards – Is the site located in a high-risk area?
- Susceptibility to Hazards – Identify the hazards that can affect your home and property.
- Slope steepness, friable soil, erosion possibilities during rainstorms, and foundation stability during an earthquake event. Find out how this will affect your septic system?
- Know what you are going to design the building to do, the heights, widths and length of the spaces and levels if more than one; evaluate the site; determine the structural system. Determine what materials you will be using; the connections between floor and wall, wall and ceiling, beams, columns; engineering –vertical and horizontal loads, the foundation, and quality control of the process.
- Determine whether terracing is required for segment footing and foundations rather than one monolith or large surface area. Use the terrain to design rather than gouging out large areas of earth to build one larger leveled slab. This permits the site to be controlled in smaller areas that are easier to master.
- Consider natural protective features. Tree line can be a natural protective feature if extreme force winds travel within that area. However, this natural feature may not be considered protective if it inhibits winds from traveling through the site, thus, creating pockets of heat

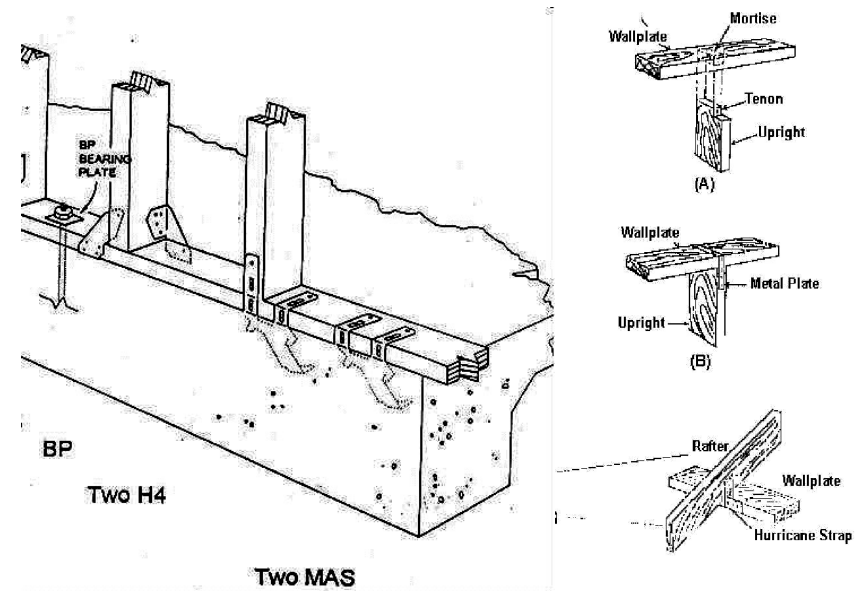


Figure 5.21 Large Connection

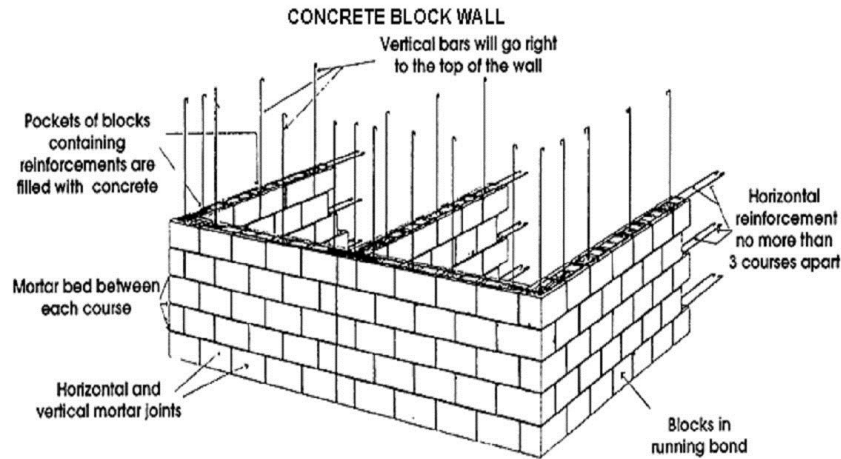


Figure 5 .20 Concrete Block Wall

- **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.

and humidity. Other protective features could be rock formations, ghuts etc.

- Consider man-made protective features such as ponds, planted trees, retaining walls
- Determine accessibility. This refers to the ability to get to the site to build, to transport, to park a car, to play, to maintain a workable septic tank system, to control runoff and subsequent erosion.

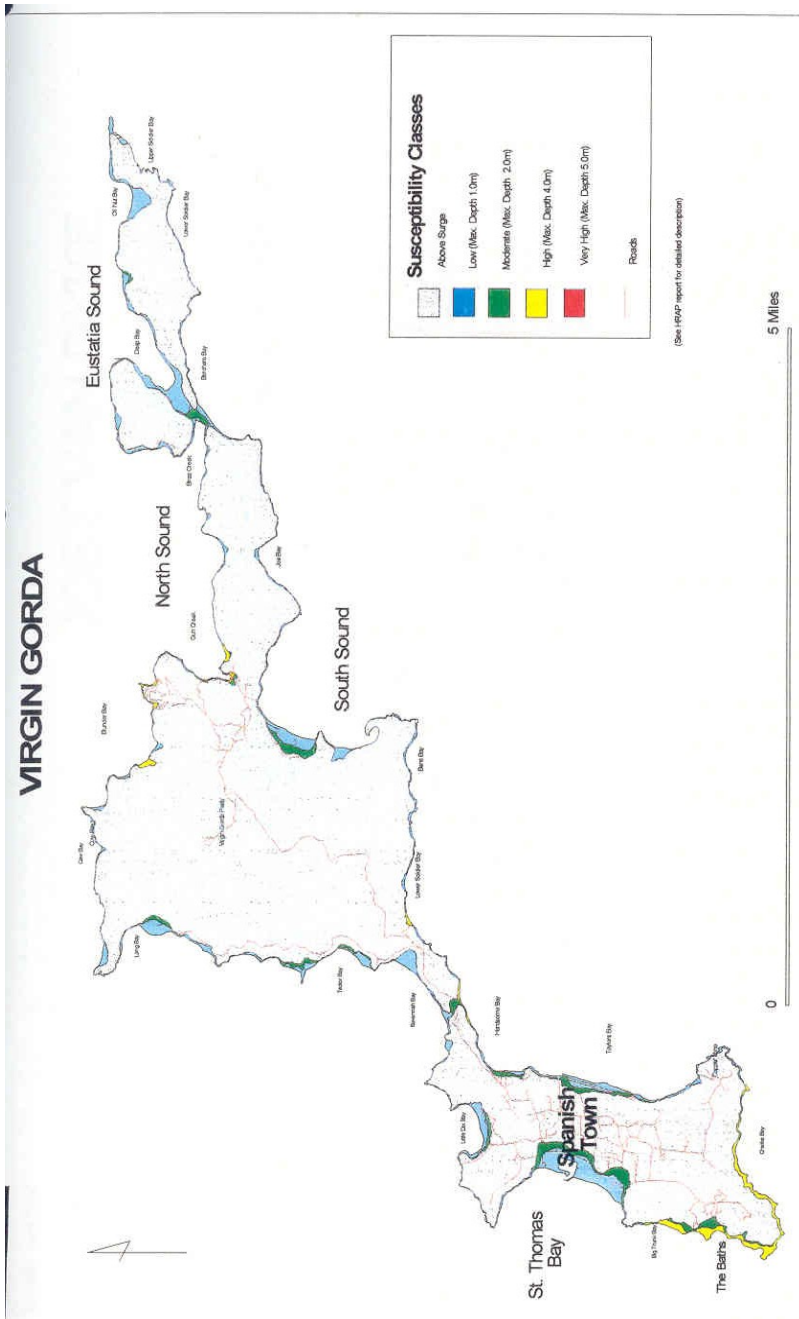


Figure 4.1 Virgin Gorda Storm Surge Susceptibility Classes

“It’s better to prepare and prevent rather than repair and repent” – S. Thomas 1856

- The Walls must be securely tied to the foundation to prevent the wind forces lifting up the entire building or blowing it over.
- **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 reinforcement, Dar-O-Wal or Brickforce, should be laid after every third course. (Two 1/4” diameter bars are often used but therefore likely to rust in the then mortar joints).
  - Horizontal reinforcement increases the resistance of the wall to hurricane force winds (add earthquakes).
  - Vertical bars are requested at all junctions, windows and door openings

“It’s better to prepare and prevent rather than repair and repent” – S. Thomas 1856



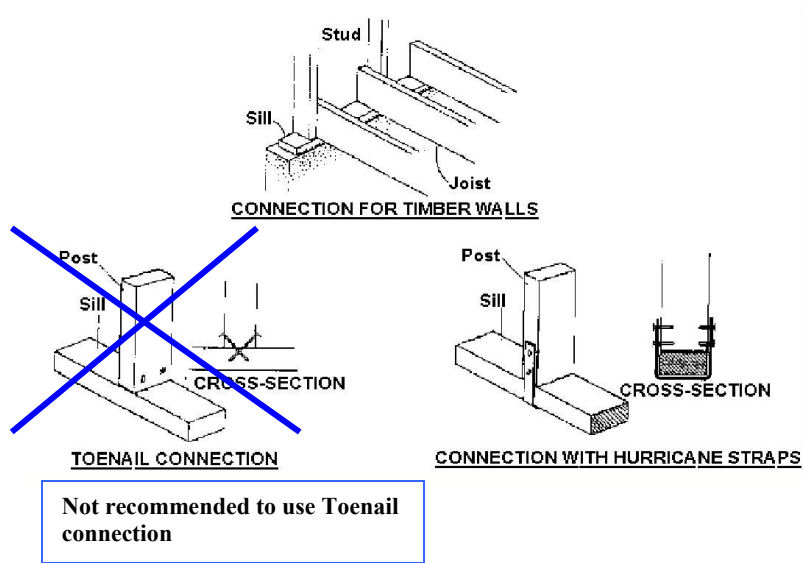


Figure 5.18 Connections for timber walls

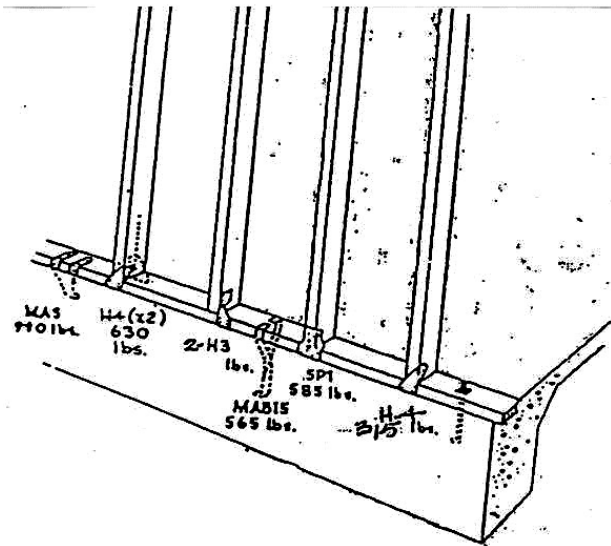


Figure 5.19 Stud Wall ties

"It's better to prepare and prevent rather than repair and repent" – S. Thomas 1856

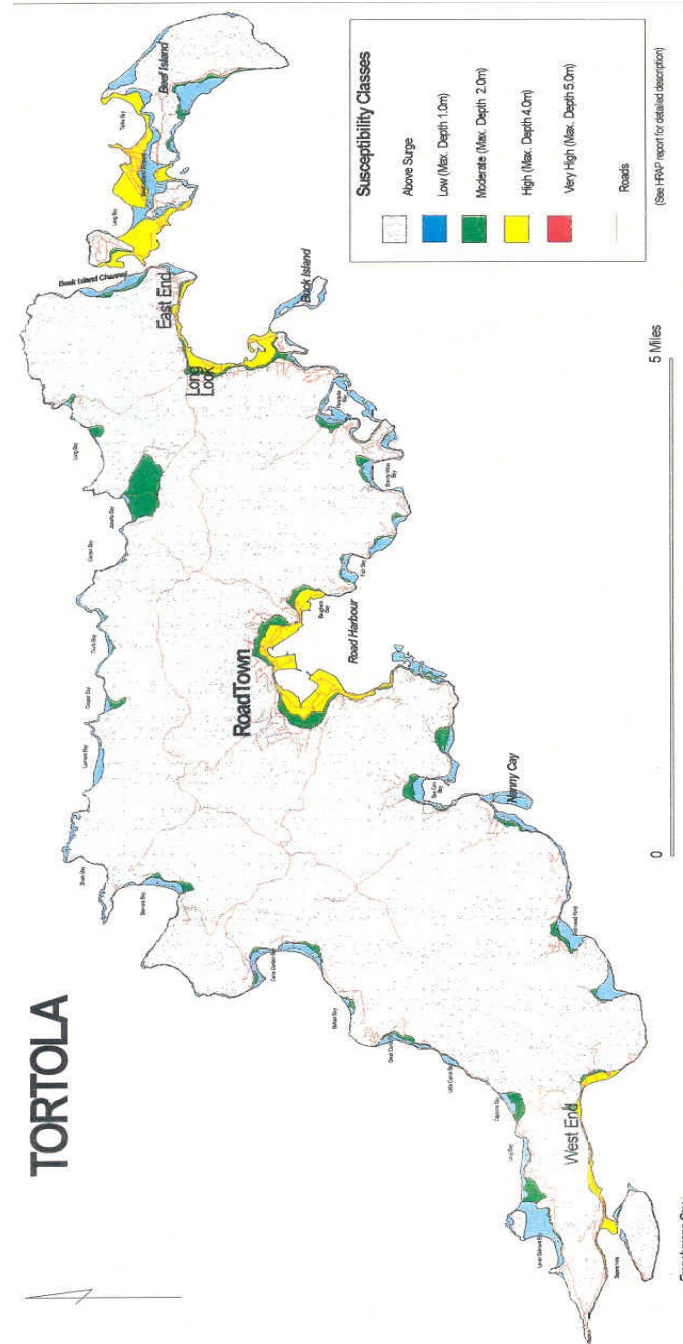


Figure 4.2 Tortola Storm Surge Susceptibility Classes

"It's better to prepare and prevent rather than repair and repent" – S. Thomas 1856

4.4 Avoid building on steep hillsides where there is very little shelter from high wind, especially on slopes facing the sea. (Building on steep hill sides should be avoided all together) But if it cannot be avoided the hillside should be cut as shown in Fig. 4.3 a, b. & Fig. 4.4. It is more suitable to build in areas, which provide natural shelter from high winds.

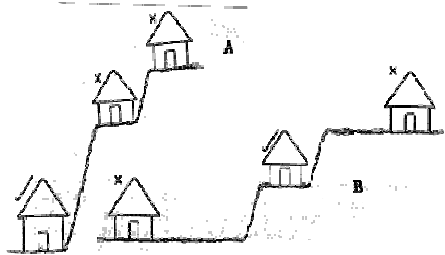


Figure 4.3: Avoid locations marked with an x

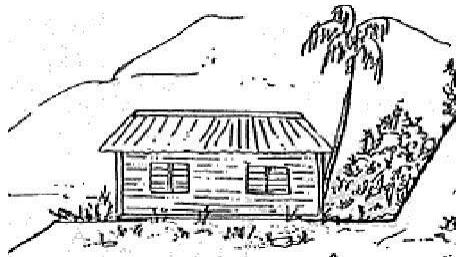


Figure 4.4: If a steep Slope cut into the earth like this.

**Builders Reminder**



When cutting into slopes for building sites, attention must be paid to the cut to ensure that erosion land slides will not result from the site work. The earth must be cut below the 'slipping' angle or angle of repose for the soil type under consideration. The cut slope needs to be protected from erosion, for instance, by the planting of shrubs or tall grasses such as ver-te-ver (Khus - khus grass).

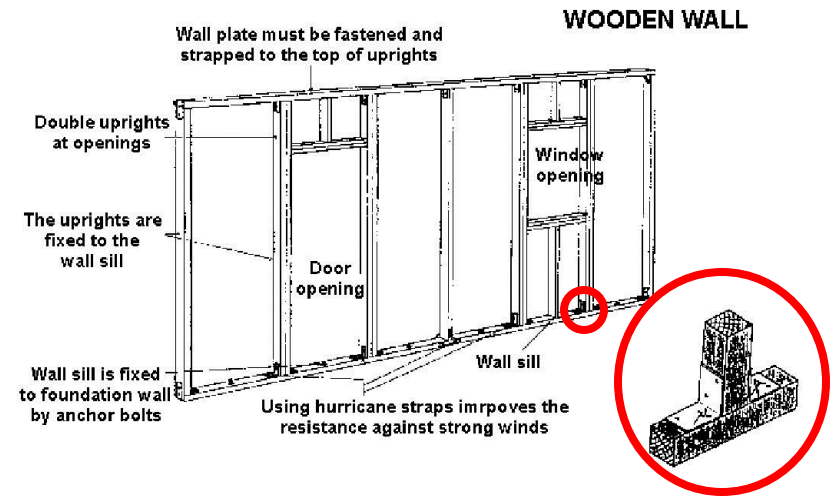


Figure 5.16 Wooden Wall Connection

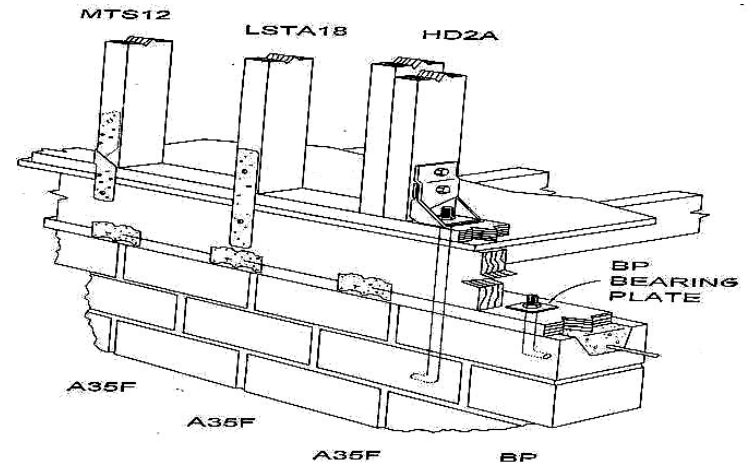


Figure 5.17 Wall to Masonry Foundation

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.

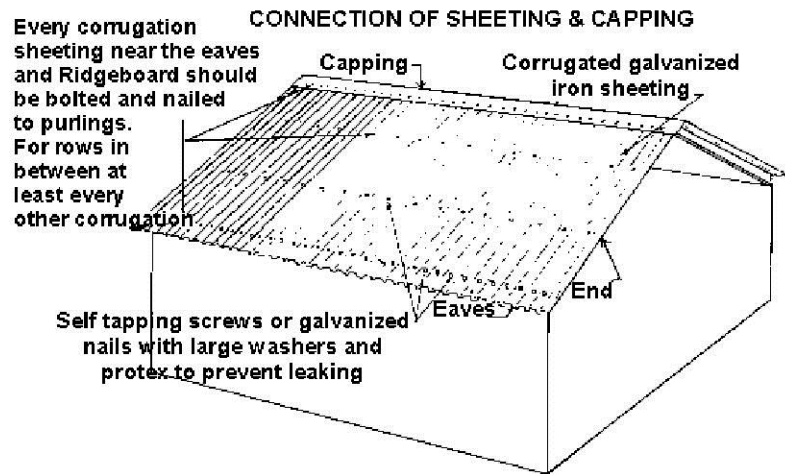


Figure 5. 15 Connection of Sheeting & Capping

- 5.3.3 The 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.

Wooden Walls: Wall plate must be fastened and strapped to the top of uprights. The uprights are fixed to the wall sill. Wall sill is fixed to foundation wall by anchor bolts. Using hurricane straps improves the resistance against strong winds.

## Section 5: Constructing The Building

### 5.1 Building Loads

All buildings and structures and all parts thereof should be designed and constructed to be of sufficient strength to support the estimated or actual imposed dead, live, wind and any other loads, both during construction and after completion of the structure, without exceeding the stresses for the various materials specified in the BVI Building Regulations; and the designer should consider the possibility of extraordinary loads being applied to the systems.

### 5.2 Building Materials

Building materials often emit (out gas) volatile organic chemicals (VOCS) into the air. Chemically sensitive people must wisely choose materials, which have low, or no VOCS. Selecting poplar or oak as hardwood (*see figure 5.1 and 5.2*), over pressed wood products which contain formaldehyde in the glue, is an example of a wise choice. Selecting a tile or hardwood floor over a synthetic carpet would also be preferred. A new or newly renovated home, which is made of 'normal' building materials, can be very hazardous to the chemically sensitive person



Figure 5.1: Hardwood (Oak)

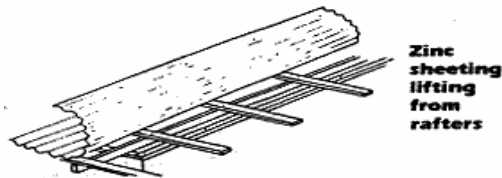


Figure 5. 2: Hardwood (poplar)

5.2.1 Galvanize - The connection of the roof covering must be given serious attention. The corrugated galvanized sheet is the most commonly used roof covering, therefore it is important to nail them carefully. If one of the sheets is separated, it could form a chain reaction pulling the others with it, leaving the exterior of the house exposed, thus risking the safety of the occupants and causing damage to personal property.

**How Damage Occurs**

Winds, travelling in excess of 65 miles per hour, causes the sheeting to vibrate pulling out the nails at the edges. The sheets then start to roll up pulling out the rest of the nails, one at a time.



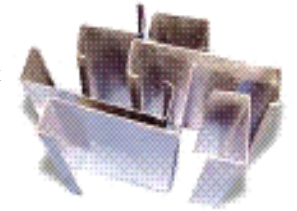
When this happens, either the nails are pulled out with the sheeting or the heads of the nails tear through the sheeting.

Figure 5.3

Damage to Galvanize Occurs

How

**Note:** Purlins are metal tracks used to support metal roofs or siding. Purlins can also mean the members placed at right angles to rafters to break up the roof board span.



• **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 fitting 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

- Hipped Roof

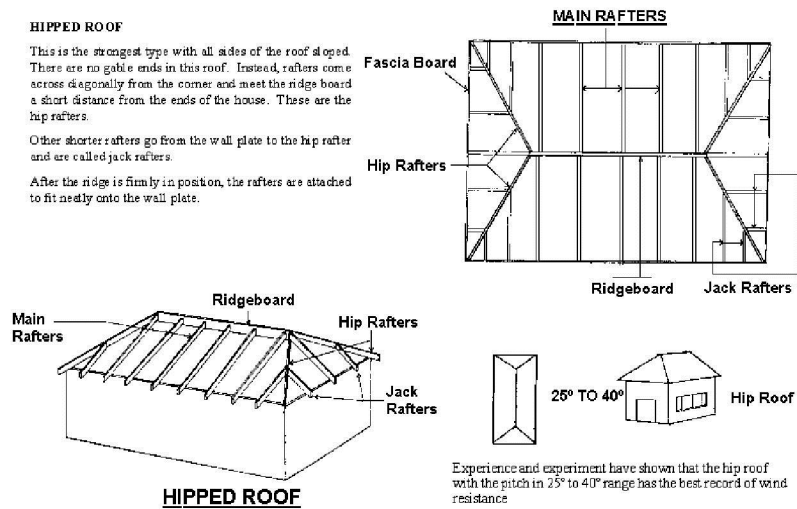


Figure 5.15 Hipped roof

Cold-formed purlins are efficient, economical structural members, produced from BHP galvaspan steel - high strength, low weight. Designed in accordance with AS4600 makes them suitable for a range of applications, including Government projects. Available in a full range of C & Z sections (which refer to specially shaped purlins). Both C & Z Sections are easily installed in a single, double, double lapped, continuous lapped and reduced end lap systems.

If galvanized sheets are used, ensure that they are properly secured to the laths so as to ensure adequate resistance in high winds. Allow appropriate overlaps to ensure that the edges of the sheets can be bent over to prevent lift in high winds. Roofing nails should be galvanized and have large steel washers at their heads

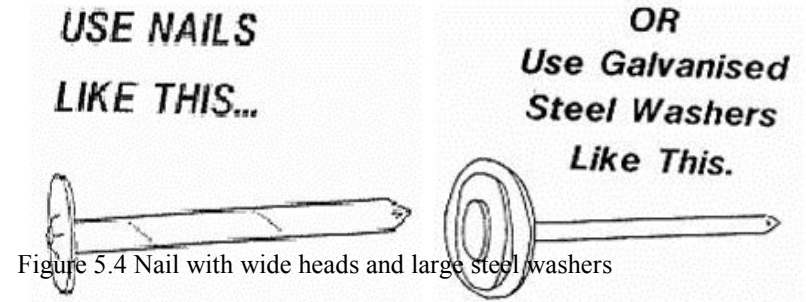
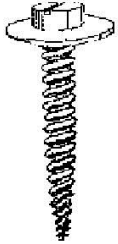


Figure 5.4 Nail with wide heads and large steel washers

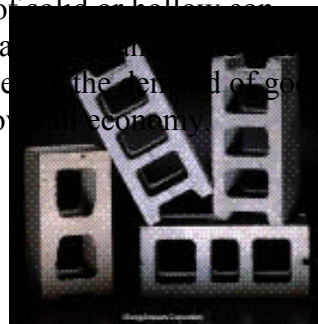
**SCREWS**



- NAILS DO NOT HOLD AS WELL AS SCREWS.
- USE PROPER DRIVE CREWS 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 PULEED UPWARD BY HIGH WINDS.
- REMEMBER TO USE SUFFICIENT SCREWS SO THAT THE EHADS WILL NOT TEAR THROUGH.

Figure 5.5 Drive Screws

5.2.2 Concrete Blocks - The use of solid or hollow concrete blocks instead of the traditional masonry construction is desirable for meeting the demand of good quality; speed of construction and of economy.



- Fixings For Sheeting

**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

Table 5.2 Laths Spacing and Fixing

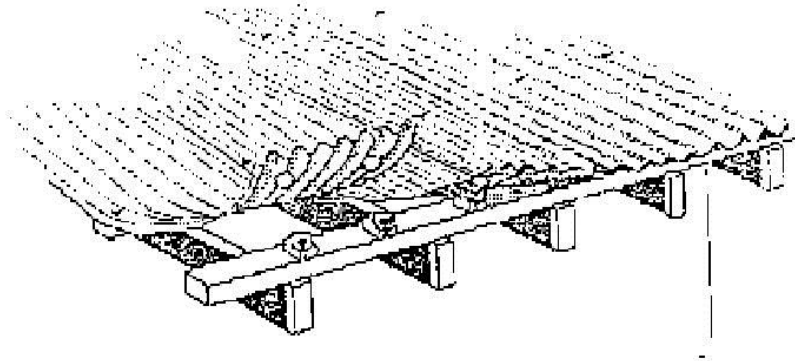
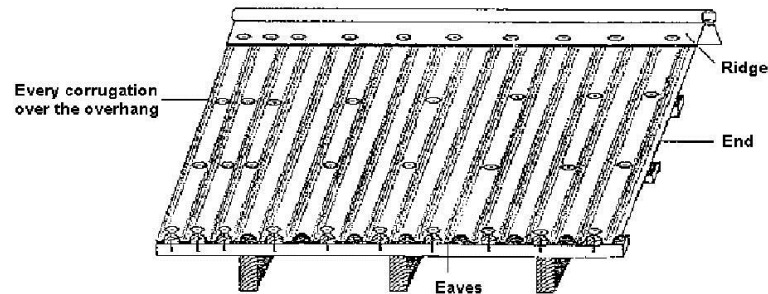


Figure 5.13 Galvanize roof with too few sheeting

- 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. See figure 5.14.



**At ridges, eaves and overhangs - fixings every two (2) corrugation.**

**All other locations, fixings every three (3) corrugation. Maximum spacing.**

Figure 5.14 Roof construction showing ridges, eaves and overhangs fixings

5.2.3 Cement - The commonly used cements in building construction are as follows:

33 grade Ordinary Portland cement (OPC)  
 43 grade Ordinary Portland cement (OPC)  
 53 grade Ordinary Portland cement (OPC)  
 Portland Pozzolana cement (PPC)  
 Blended cement

33 grade means that the strength of OPC is 33 Mpa ( $1 \text{ N/mm}^2 = 1 \text{ Mpa} = 10 \text{ kg/cm}^2$ ) at 28 days age.

For general construction, 33-grade cement is the best. 53-grade high strength cement should not be used as far as possible. **THE CEMENT MORTAR OR CONCRETE MUST BE USED WITHIN 30 MINUTES OF ITS PREPARATION. THE UNUSED MORTAR OR CONCRETE MUST BE REJECTED.**

The pozzolana cements contain up to 35% finely blended fly ash and are quite satisfactory for use in general construction. They are slow to gain strength in the first two or three weeks, however, after 28 days, their strength is at par with 33 grades OPC. The pozzolana cements are more durable than OPC.

#### Unit of Measurement

Mpa - Mega Pascal (Pressure)

$\text{N/mm}^2$  - Newton per Millimeter Squared (Stress)

Kg - Kilogram (Weight)

Cm - Centimeter (Length)

**MONTH OF MANUFACTURE** - A bag of cement contains 50 kg of cement. The cement bag carries the WEEK / MONTH and YEAR of manufacture. The cement should be used at the earliest but not later than 3 months from the date of its manufacture. In any case, the cement should be free from lumps and balls at the time of use.

**STORAGE OF CEMENT** - The cement should be stored in a covered room having proper ventilation and free from humidity. It should be stored at least 15 cm above the floor. The cement should be stacked such that there is free circulation of air all around each stack.

- 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 sheeting.
  - Use fittings with a broad washer or dome head (zinc nail). To use more fixings for each sheet, put in the laths at closer centers and nail closer together.
- Corrugated galvanize sheets are gauged by numbers. The Higher the number the thinner the material. Example 24 Gauged galvanize is superior to 28 gauged.

#### HOW DOES ROOF SHEETING FAIL IN HURRICANES?

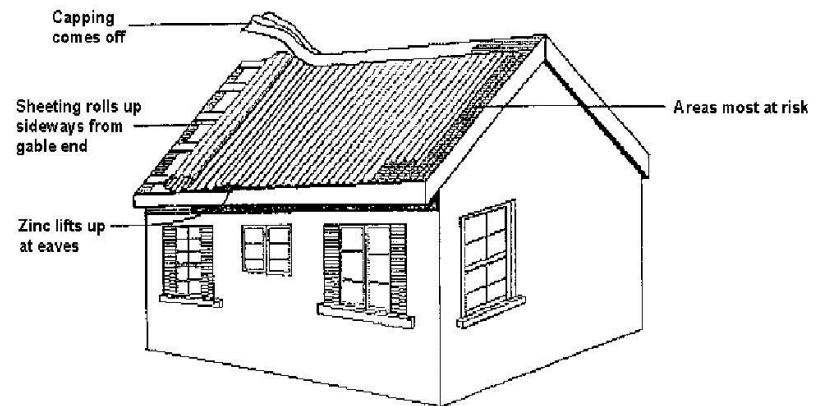


Figure 5.12 How does roof sheeting fail in Hurricane



5.2.4 Sand - The fine aggregate or sand may be natural or crushed. It may be available in a quarry. The size of sand particles varies from a maximum of 4.75 mm down to 150 micron, that is, 0.150 mm.

Good sand must contain all the particles within the above range, that is, it should be graded sand. The sand may be sieved through the following Indian Standard Sieves: 4.75 mm, 2.36 mm, 1.18 mm, 600 micron, 300 micron and 150 micron. The sand may be classified as VERY COARSE (ZONE I), MEDIUM COARSE (ZONE II), COARSE (ZONE III) and FINE (ZONE IV) depending upon its grain size distribution.

Sand must be clean and free from clay, alkali and organic matter. There must be no SILT or dust in sand. If necessary, sand must be sieved from 4.75 mm and 150 micron IS sieves, washed and dried for 72 hours before use.

Sand must be stored separately from coarse aggregate or bajri or lime etc. on a clean and hard surface. Moist or wet sand must not be used in construction.

Figure 5.10 Collar Ties, Gussets and Metal straps connection for roof

**ROOF CONNECTIONS FOR CONCRETE WALL**

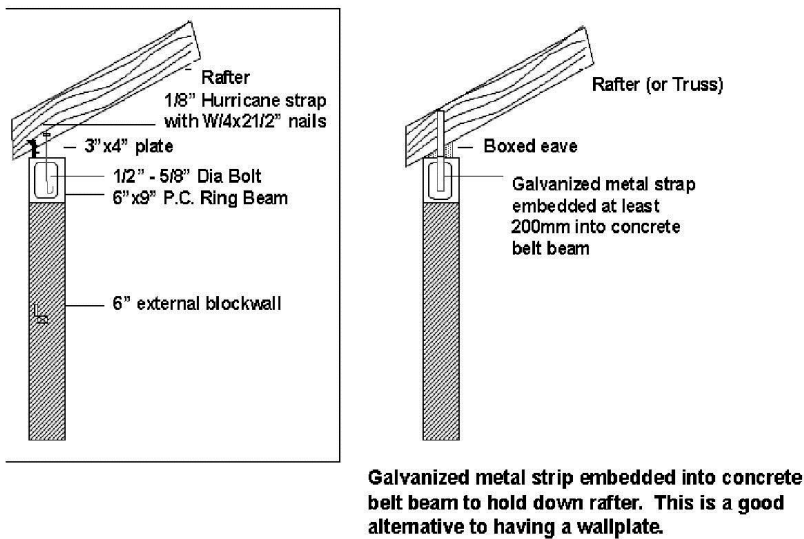


Figure 5.11 Roof Connections

5.2.5 Water - The water used for both mixing and curing of concrete should be free from impurities, injurious amounts of acids, alkalis, salts, and organic matter. Potable water is considered satisfactory for mixing concrete. The water should be colorless and free from any smell. The presence of chlorides and sulphates are injurious to reinforcing bars as they may be corroded.

5.2.6 Steel Reinforcing - Vertical reinforced columns should be placed in all masonry walls with a maximum dimension between columns of 16'-0".

All exterior walls and interior walls should be reinforced. All corners and junctions should be reinforced and core filled. Reinforce and tie windows and door jambs into lintels.

Fix all vertical reinforcement to foundation and belt course. Fix all vertical reinforcement to the ring beam. Place horizontal reinforcement every three courses.

Lap and securely tie all reinforcement that is not continuous. Fill block cores after laying every three courses with well-compacted concrete or poured grout.

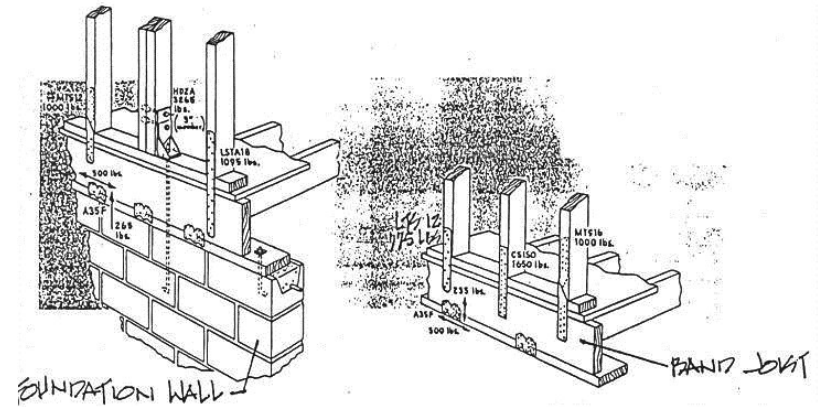


Figure 5.9 Wall Connection to Foundation

5.3.2 The Roof - Roofs are the most vulnerable part of a building during a hurricane. Therefore, it must be strong and resistant to high winds. If the hip roof can be afforded, it should be given priority over the other types.

- When 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: collar ties, gussets and metal straps connectors.

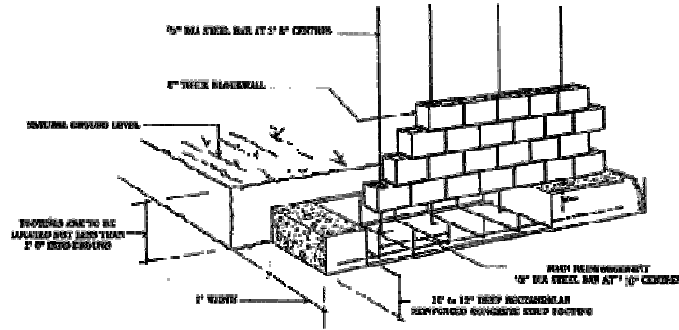


Figure 5.8 a

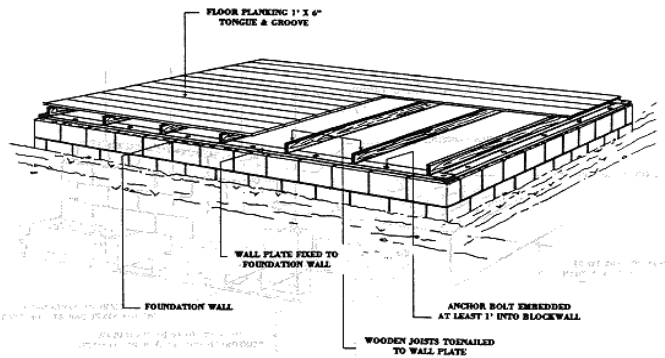


Figure 5.8 b

**Builders Reminder**



- Design and construct foundations using quality materials and ensure that steel bars extend beyond the foundation walls to aid proper securing of the wooden structure.
- Foundations of buildings located in floodplains must be designed to withstand dynamic water force and battering action from floating debris, and the effects of erosion due to scouring.

For wood construction, use-reinforcing straps at the foundation to the header at the floor, diagonally tying studs, strapping corner stud assemblies at third points, and tying rafters to top plates.

5.2.7 Gravel - refers to small stones, generally 5-30 mm in diameter that may be angular or rounded. Angular gravels are usually sourced from quarries, a by-product of the crushing processes, whereas rounded gravels are from a fluvial source, such as an old river bed, beaches, and channel dredging. Gravels can be of almost any colour, depending on the parent rock type, or even a multi-coloured blend

The gravels most commonly used as a loose surface dressing are in the 6-20 mm size range. Anything less than 6 mm is more akin to a grit and is too easily disturbed; anything over 18-20 mm can be difficult to walk upon. In general, the smaller 6-10 mm gravels would be used for footpaths and the 10-18 mm gravels for driveways, but it really is a matter of personal taste. One deciding factor could be that, the smaller the gravel, the more the cats like to use it as a toilet!

### 5.3 Safer Building Construction

5.3.1 Foundation - 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.

Figure 5.6 Types of Foundations

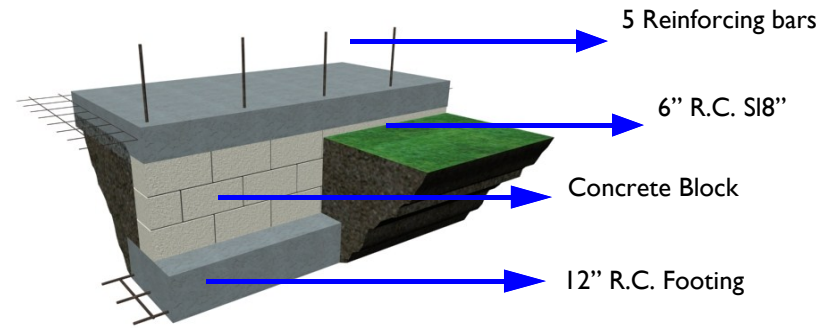
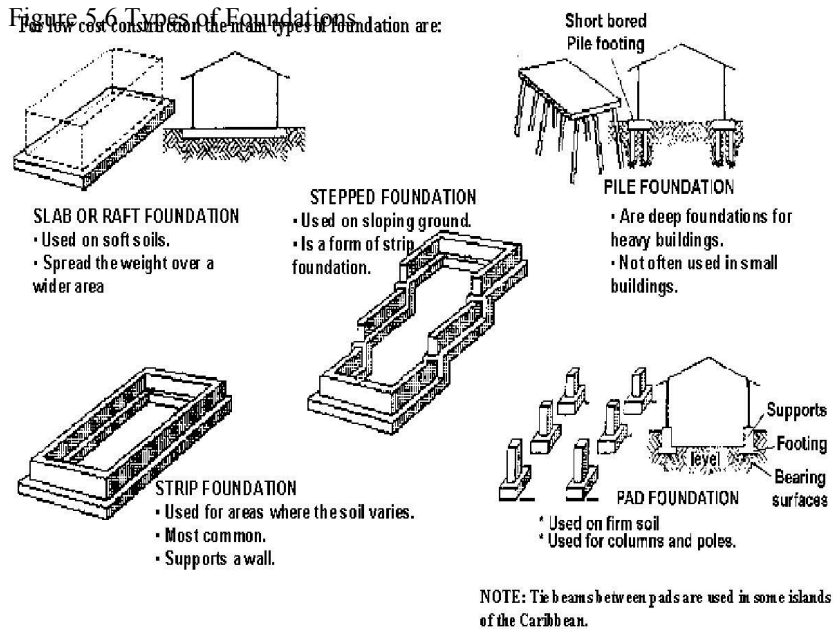


Figure 5.7 Proper Foundation

For the construction of a reinforced concrete block wall with 1/2" mild steel bars, the use of mild steel is encouraged since it is easier to bend compared to high tensile steel. These bars must be continuous and project beyond the foundation by at least 12" to 14"(300 mm to 350 mm) to facilitate the securing of the structure to the foundation. See Fig. 5.8, a & b and 5.9