CDEMA
CARIBBEAN DISASTER EMERGENCY MANAGEMENT AGENCY
Resilient States · Safer Lives

Pocket Guide

Construction Site Supervision of Houses

A publication of the Caribbean Disaster Emergency Management Agency
Resilience Way, Lower Estate
St Michael, Barbados Tel: (246) 434 4880; Fax: (246) 271 3660
www.cdema.org [978-976-8243-37-9] (E-book)
Cover Design: IDS Creative Inc

Note: This document was prepared based on information available at 14th April 2023.

Printed in Barbados

Norway

CARIBBEAN DEVELOPMENT BANK

"This publication has been produced with financial support from Norway and the Caribbean Development Bank (CDB). The contents of this publication are the sole responsibility of CDEMA and do not reflect the views of the Government of Norway or the CDB".

Pocket Guide

Construction Site Supervision of Houses

ACKNOWLEDGEMENTS

Thanks are extended to Dr. Grenville Phillips, who drafted the Pocket Guide for Construction Site Supervision of Houses through the joint-venture consultancy of Walbrent College and Beston Consulting Ltd. Additionally, the contributions of members of the project steering committee who reviewed the Pocket Guide and provided guidance and feedback is greatly appreciated and was invaluable. Namely:

Mr. Fulgence St. Prix CARICOM Regional Organisation for Standards and Quality (CROSQ)
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The content of the Pocket Guide was developed from the CARICOM Regional Code of Practice for the Construction of Houses (CRCP 10: 2023) which was also drafted by Dr. Grenville Phillps with supervision from the CROSQ Regional Project Team (RPT) for CRCP 10:2023. Special thanks are extended to members of the RPT which was hosted by the Dominica Bureau of Standards and the St. Vincent and the Grenadines Bureau of Standards; and comprised of representatives from Antigua and Barbuda, Barbados, Dominica, Guyana, Haiti, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

The Government of Norway is gratefully acknowledged for the financing they provided for the development of the Pocket Guide under the project, Support to the Advancement of Comprehensive Disaster Management (CDM) in the CDEMA Participating States, which was implemented by CDEMA and coordinated by Mr. Clive Murray. The Caribbean Development Bank is also acknowledged for the support they provided to CDEMA for the publication of the Pocket Guide through its Caribbean Technological Consultancy Services (CTCS) Network under the project Improved Practices for the Construction of Houses in the Caribbean.

The Pocket Guide is one of six resources developed by CDEMA for safer building in the Caribbean, that includes, an Answer Booklet, Learner's Guide, Curriculum, the Occupational Standard for the Caribbean Vocational Qualification (CVQ)- Level 3 in Construction Site Supervision (CCBCM30123), and CRCP 10: 2023. Thanks are extended to the team that coordinated the development of these resources which was led by Dr. Nicole Greenidge in partnership with CROSQ and the Caribbean Association of National Training Authorities (CANTA). Special thanks are also extended to the CDEMA Coordinating Unit's management team, project coordinators and other team members for their invaluable contributions.

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The numbers of these Tables and Figures mirror those found in the Learner's Guide for easy reference. Note that not all of the Tables and Figures from the Learner's Guide are used in this Pocket Guide.

LIST OF FIGURES

1 INTRODUCTION

1.1 WELCOME

Welcome to this Pocket Guide. It is designed as an on-site reference aid to determine the sizes of construction elements.

The content was developed from the *Learner's Guide, for the Short Course Caribbean Vocational Qualification Occupational Standard: CCBCM30122 Level 3 - Construction Site Supervision* which was in turn developed from the *CARICOM Regional Code of Practice- Construction of Houses (CRCP 10: 2023)*, and supports the *Occupational Standard for Caribbean Vocational Qualifications (CVQ) - Level 3 in Construction Site Supervision*.

The tables and figures and their reference numbers mirror those in the Learner's Guide for easy reference. Note that not all of the tables and figures from the Learner's Guide were used in this Pocket Guide. Additional details on each section may be found in the Learner's Guide.

1.2 LIMITS

This Guide is applicable to the structural construction of houses in the Caribbean. It applies to single-storey houses up to a 7.62 m x 12.19 m or 92.9 sq-m (25 ft x 40 ft or 1,000 sq-ft) plan, with hollow block masonry or timber framed walls, and timber framed or concrete roofs.

This Guide does not include construction details for utilities (including plumbing, electrical, communications, security, and natural gas), since these are normally outsourced to specialist sub-contractors. Neither does it include construction

details for solid brick masonry.

To reduce the risk of misinterpreting information in this Guide, the following symbols and abbreviated terms are used.

dia	Diameter
ft	Foot or feet
gal	US gallon
km	Kilometre
kN	Kilonewton
kg	Kilogram
m	Metre
m^2	Square metre
m^3	Cubic metre
mm	Millimetre
MPa	Megapascal (N/mm2)
mph	Miles per hour
m/s	Metres per second
Mw	Moment magnitude
N	Newtons
No.	Number
psi	Pounds per square inch
sq-ft	Square feet
SS	Structural Select
US	United States of America

The remainder of this Guide will be referring to construction materials, which are to be assembled to build a house. The assembling may be done by: mixing, nailing, screwing, bolting, cementing, fitting, and compacting.

3 CONSTRUCTION MATERIALS

3.1 MIXING CEMENTITIOUS MATERIALS

Table 1 presents the mixtures for concreted and grouted elements, and Table 2 presents the mixtures for mortar. The mixtures are based on using 5-gallon buckets since they are normally used on residential construction sites in the Caribbean.

TABLE 1 - MIXTURES FOR CONCRETED AND GROUTED ELEMENTS

Elements	28 - Day Compressive Cube Strength (MPa = N/mm^2)	Cement	Sand	Aggregate	Water	Slump
Footings, Slab on grade	21 MPa (3,000 psi)	1 cu-ft (1.5 x 5 gal)	2 cu-ft (3 x 5 gal)	4 cu-ft (6 x 5 gal)	5 gal	50 to 100 mm (2” to 4”)
Beams, Suspended slabs, Columns	25 MPa (3,600 psi)	1 cu-ft (1.5 x 5 gal)	1.5 cu-ft (2.25 x 5 gal)	3 cu-ft (4.5 x 5 gal)	5 gal	50 to 100 mm (2” to 4”)
Walls (grout for block’s cores)	15.8 MPa (2,300 psi)	1 cu-ft (1.5 x 5 gal)	3 cu-ft (4.5 x 5 gal)	6 cu-ft (9 x 5 gal)	5 gal	115 to 230 mm (4 ½” to 9”)
Note: One (1) bag of cement = 94 lb bag = 1 cu-ft = 1.5 x 5-gallon buckets.						

TABLE 2 - MIXTURE FOR MORTAR					
Elements	28 - Day Compressive Cube Strength (MPa = N/mm²)	Cement	Lime (optional, but highly recommended for plaster)	Water	Sifted Sand
Mortar for repairs and below grade masonry work	16.8 MPa (2,400 psi)	1 cu-ft (1.5 x 5 gal)	½ cu-ft (0.75 x 5-gal)	5 gal	3 cu-ft (4.5 x 5-gal)
Mortar for block joints and plastering walls above grade	11.2 MPa (1,600 psi)	1 cu-ft (1.5 x 5 gal)	½ cu-ft (0.75 x 5-gal)	5 gal	4 cu-ft (6 x 5-gal)

The compressive strength of concrete is normally measured at 28 days. It is sampled at the site in either 150 mm (6") cubes or 100 mm (4") diameter, 200 mm (8") long cylinders, and crushed. The cylinder strength is approximately 80% of the cube strength (BS EN 1992-1-1:2004, Table 3.1) as shown in Table 3.

TABLE 3 – CYLNDER AND CUBE COMPRESSIVE STRENGTH		
28-day Compressive Strength class	**Minimum characteristic cylinder strength**	**Minimum characteristic cube strength**
C12/15	12 MPa (1,700 psi)	15 MPa (2,100 psi)
C16/20	16 MPa (2,300 psi)	20 MPa (2,900 psi)
c20/25	16 MPa (2,300 psi)	25 MPa (3,600 psi)
c25/30	25 MPa (3,600 psi)	30 MPa (4,300) psi
Source: BS EN 206:2013+A1:2016, Table 12		

The common British BS 4449 rebar grade is B500B for high tension 500 MPa (72,500 psi). The common British BS 4482 rebar grade for mild steel is 250 MPa (36,260 psi). Table 4 describes the diameters of each grade.

TABLE 4 – REBAR DIAMETERS OF EACH GRADE.			
ASTM A615		BS 4449 and 4482*	
Bar Designation. [No.] Metric (imperial)	Nominal Diameter: Metric (imperial)	Bar Diameter. Metric (imperial)	Nominal Diameter: Metric (imperial)
		6 mm (1/4")*	6.0 mm (0.236")*
		8 mm (5/16")*	8.0 mm (0.315")*
[3] 10 mm (3/8")	9.5 mm (0.345")	10 mm (3/8")*	10.0 mm (0.345")*
[4] 13 mm (4/8")	12.7 mm (0.5")	12 mm (4/8")*	12.0 mm (0.5")*
[5] 16 mm (5/8")	15.9 mm (0.625")	16 mm (5/8")	16.0 mm (0.625")
[6] 19 mm (6/8")	19.1 mm (0.75")	20 mm (6/8")	20.0 mm (0.75")
[8] 25 mm (8/8")	25.4 mm (1")	25 mm (1")	25.0 mm (0.984")
Source: ASTM A615-15, Table 1. BS 4449:2005, Table 7. BS 4482:1985, Table 1.			

3.2 REINFORCEMENT (REBAR)

Steel reinforcement (rebar) may be ribbed (deformed) high tension (high yield) steel rods (bars), or smooth mild steel rods (bars) (see Figure 3). All main structural rebars should be ribbed (deformed).

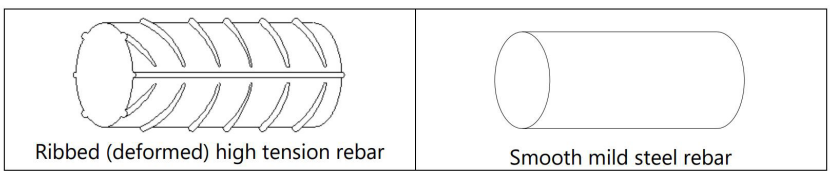


FIGURE 3 - RIBBED AND SMOOTH REBARS

In this Guide, high-tension rod diameters are prefixed with “H”. For example, a 12 mm (1/2”) diameter high tension rod is referenced H12. Mild steel rod diameters are prefixed with “R”. For example, an 8 mm (5/16”) diameter mild steel rod is referenced R8.

3.3 REBAR BEND DIAMETERS

Rebars should be bent around minimum bending diameters (see Figure 4). Tables 5a and 5b show the minimum rebar inside diameters for the mild steel and high tension grades, respectively.

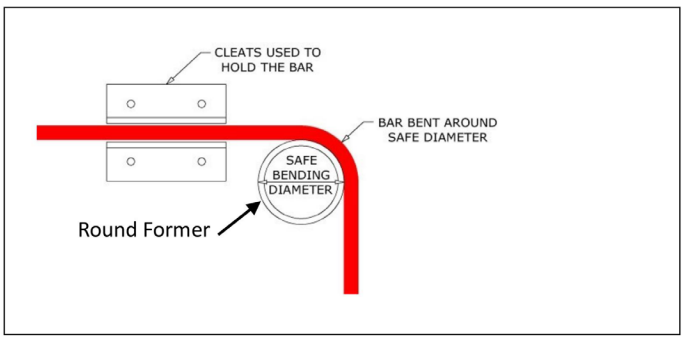


FIGURE 4 - BENDING REBARS

TABLE 5A - MINIMUM BEND DIAMETERS FOR MILD STEEL (GRADE 40) (CoP TABLE 5)			
Rebar Manufacturing Standard			
ASTM A615 (Grade 40)		BS 4482 (Mild Steel)	
Bar Designation. [No.] Metric (imperial)	Minimum inside bend diameter Metric (imperial)	Bar Diameter. Metric (imperial)	Minimum inside bend diameter Metric (imperial)
		6 mm (1/4”)	24 mm (0.94”)
		8 mm (5/16”)	32 mm (1.26”)
[3] 10 mm (3/8”)	40 mm (1.5”)	10 mm (3/8”)	40 mm (1.57”)
[4] 13 mm (1/2”)	52 mm (2.0”)	12 mm (4/8”)	48 mm (1.90”)

TABLE 5B - MINIMUM BEND DIAMETERS FOR HIGH TENSION (GRADE 60) (COP TABLE 5)			
Rebar Manufacturing Standard			
ASTM A615 (Grade 60)		BS 4449 (High Tension)	
Bar Designation. [No.] Metric (imperial)	Minimum inside bend diameter Metric (imperial)	Bar Diameter. Metric (imperial)	Minimum inside bend diameter Metric (imperial)
		6 mm (1/4”)	24 mm (0.94”)
		8 mm (5/16”)	32 mm (1.26”)
10 mm (3/8”)	57 mm (2.24”)	10 mm (3/8”)	40 mm (1.57”)
13 mm (1/2”)	76 mm (3.0”)	12 mm (4/8”)	48 mm (1.90”)
16 mm (5/8”)	95 mm (3.75”)	16 mm (5/8”)	64 mm (2.52”)
19 mm (3/4”)	115 mm (4.5”)	20 mm (6/8”)	140 mm (5.51”)
25 mm (1”)	152 mm (6.0”)	25 mm (1”)	175 mm (6.90”)

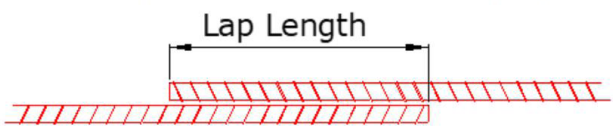
If the grade of rebar is unknown, then the larger inside bend diameters presented in Tables 5a and 5b should be used.

3.4 REBAR LAP LENGTHS

To effectively transfer the tension load from one bar to another, a minimum lap length of fifty (50) times the rebar diameter should be used irrespective of grade.

TABLE 6 - LAP LENGTHS (NOT IN COP)

Bar Diameter, mm (in)	Lap Length, mm (in)
6 (1/4”)	300 (12”)
8 (5/16”)	400 (16”)
10 (3/8”)	500 (20”)
12 (1/2”)	600 (24”)
16 (5/8”)	800 (32”)
20 (3/4”)	1000 (40”)
25 (1”)	1250 (48”)



3.5 CONCRETE COVER

The minimum cover requirements are determined from the most conservative American (ACI 314-14, Table 20.6.1.3.1) and British (BS EN 1991-1-1 and BS EN 1991-1-2) requirements, and are provided in Table 7.

TABLE 7 – CONCRETE COVER TO REBARS TO GIVE A MINIMUM FIRE PROTECTION OF 1.5 HOURS

Element	Concrete Cover Metric, (Imperial)
Foundations – in contact with the ground	75 mm (3”)
Slabs, walls, beams and columns exposed to weather	40 mm (1.5”)
Slabs not exposed to weather	25 mm (1”)
Walls not exposed to weather	25 mm (1”)
Beam not exposed to weather	40 mm (1.5”)
Column not exposed to weather	40 mm (1.5”)

3.6 HOLLOW CONCRETE AND CLAY BLOCKS

Hollow concrete blocks should comply with the requirements of ASTM C90. Hollow clay blocks should comply with the requirements of ASTM C652. The dimensional requirements are provided in Figure 8 and Table 8. Note that this standard does not apply to solid bricks.

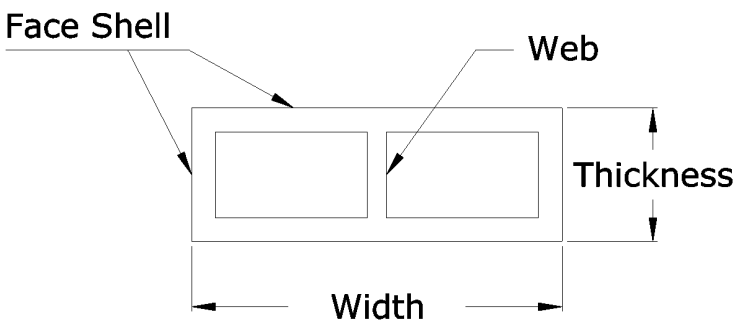


FIGURE 8 - PLAN OF CONCRETE BLOCK

TABLE 8 - DIMENSIONS OF CONCRETE BLOCKS				
Nominal block size (Thickness x Width)	Concrete blocks		Clay blocks	
	Face shell thickness Metric (Imperial)	Web thickness Metric (Imperial)	Face shell thickness Metric (Imperial)	Web thickness Metric (Imperial)
150 x 400 mm (6” x 16”)	25 mm (1”)	19 mm (3/4”)	25 mm (1”)	25 mm (1”)
200 x 400 mm (8” x 16”)	32 mm (1.25”)	19 mm (3/4”)	32 mm (1.25”)	25 mm (1”)

3.7 REINFORCEMENT OF HOLLOW CONCRETE AND CLAY BLOCKS

Vertical rebars should be placed and grouted at all wall junctions and ends, and at the open cores bounding window and door openings. Exterior wall rebars should be high tension H12 (1/2") at 600 mm (24") centres. Interior wall rebars should be H12 (1/2") at 800 mm (32") centres).

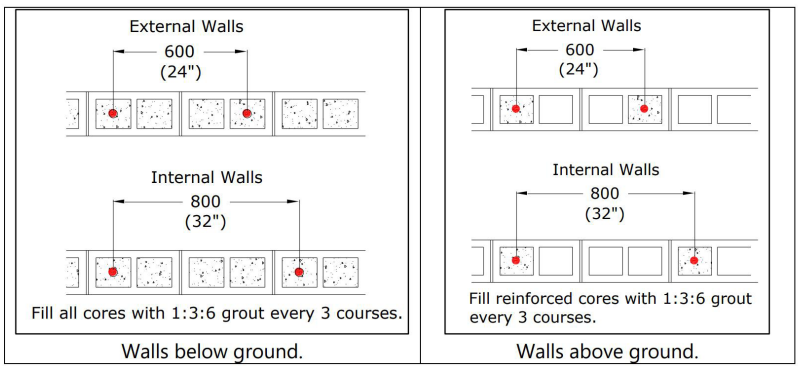


FIGURE 10 - REBAR SPACING IN WALLS

At block wall junctions, one H12 (1/2" diameter) rebar should be placed and grouted in the intersecting core, and in all cores bounding that intersecting core. Horizontal reinforcement (galvanised 3.6 mm (0.14") nominal diameter ladur or truss type high tension (Grade 60)) must be placed in every other row (spaced 400 mm (16")). R6 (1/4" diameter mild steel) horizontal ties must be used to tie the vertical rebars at junctions. The ties should be spaced 400 mm (16") apart vertically.

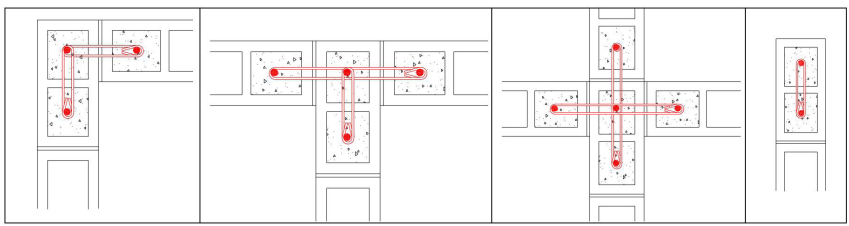


FIGURE 11 - REBAR TIES (R6@400) AT WALL JUNCTIONS AND END

4 FOUNDATIONS

4.1 SOIL BEARING CAPACITY

The maximum allowable safe bearing capacity for various soils is provided in Table 10.

TABLE 10 - MAXIMUM ALLOWABLE SAFE BEARING CAPACITY OF SOILS

Soil	Maximum Allowable Safe Bearing Capacity when Dry [Wet]	
	(kN/m2)	(Tons/sq-ft)
1. Thick layers (beds) of hard unweathered limestones and sandstones.	4,000 [4,000]	40 [40]
2. Strong shales, mudstones and siltstones.	2,000 [2,000]	20 [20]
3. Thin layers (beds) of limestones and sandstones.	1,000 [1,000]	10 [10]
4. Compact well-graded fill.	400 [200]	4 [2]
5. Loose well-graded sand	200 [100]	2 [1]
6. Compact uniform sands.	200 [100]	2 [1]
7. Loose uniform sands.	100 [50]	1 [0.5]
8. Stiff clays and sandy clays.	200 [100]	2 [1]
9. Firm clays and sandy clays.	100 [50]	1 [0.5]
10. Soft clays and silts.	50 [0]	0.5 [0]
Source: OECS Building Code, 2016. Table 13-1.		

4.2 STRIP FOOTINGS

On relatively flat ground, with slope less than 1 (Vertical) : 8 (Horizontal), reinforced concrete strip footings may be a more economical option as shown in Figure 14. Strip footings are to have the size, strength, and reinforcement specified in Table 11, and arranged in Figure 15, that corresponds to the soil bearing capacity.

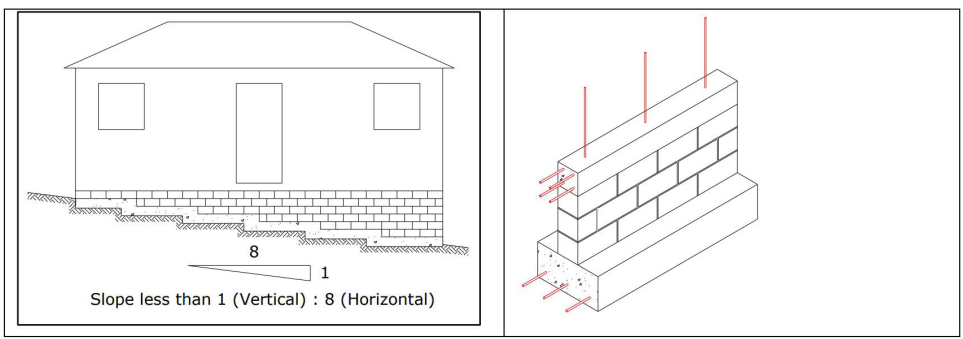


FIGURE 14 - STRIP FOOTING

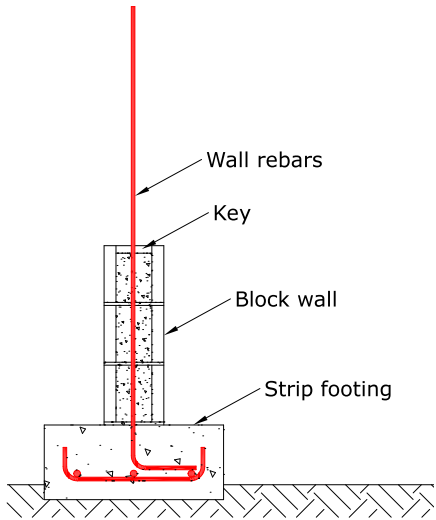


FIGURE 15 - STRIP FOOTING REINFORCEMENT

TABLE 11 - STRIP FOOTING SIZES AND REINFORCEMENT

Structural Element [Bearing Capacity]	Minimum Size (width x depth)	Minimum Concrete 28-day compressive cube strength (see Table 3 for equivalent cylinder strengths)	Minimum Reinforcement (Placed at bottom of footing with required cover.) (Equivalent Grade 60 rebar sizes in Table 4 may be used)
Strip footing on stiff clays. [100 kN/m2 (1 Ton/sq-ft)]	760 mm x 300 mm (30”x12”)	21 MPa (3,000 psi)	2 x H12 (1/2”) rebars longitudinally + H12 mm rebars spaced at 300 mm (12”) centres transversely.
Strip footing on compacted granular soil. [200 kN/m2 (2 Tons/sq-ft)]	600 mm x 275 mm (24”x11”)	21 MPa (3,000 psi)	2 x H12 (1/2”) rebars longitudinally + H12 mm rebars spaced at 300 mm (12”) centres transversely.
Strip footing on rock. [450 kN/m2 (4.5 Tons/sq-ft)]	400 mm x 275 mm (16”x11”)	21 MPa (3,000 psi)	2 x H12 (1/2”) rebars longitudinally + H12 mm rebars spaced at 300 mm (12”) centres transversely.
Ring beam at floor level.	200 mm x 200 mm (8”x8”)	25 MPa (3,600 psi)	4xH12mm (1/2”) bars with T6 (1/4”) links at 150 mm (6”) spacing.

NOTE:
The bearing capacities in Table 11 were used to determine the prescriptive footing sizes. Building on other soils will require civil engineering advice.

4.3 PAD FOOTINGS

If the land is sloping steeply, undulating severely, or good bearing soil is deep, then reinforced concrete (RC) pad footings supporting RC columns and beams may be an economical option. Pad footings are to have the size, strength, and reinforcement specified in Table 12, that corresponds to the soil bearing capacity.

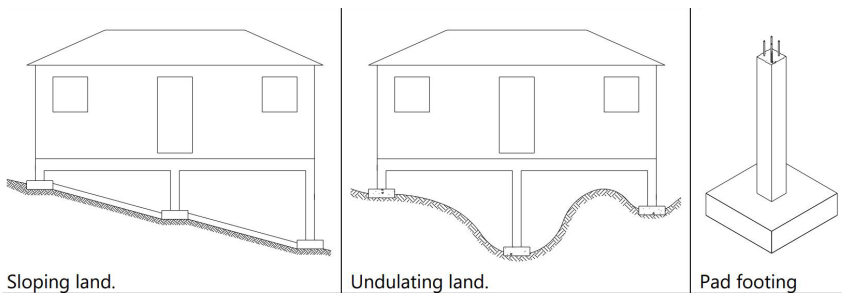


FIGURE 17 - PAD FOOTINGS

TABLE 12 - PAD FOOTING SIZES AND REINFORCEMENT			
Pad Footing [Bearing Capacity]	**Minimum Size (length x width x depth) (Note 1)**	**Minimum Concrete 28-day compressive cube strength (Note 2)**	**Minimum Reinforcement – each way top and bottom. (Note 3)**
Pad footing on stiff clays. [100 kN/m2 (1 Ton/sq-ft)]	1,200 mm x 1,200 mm x 300 mm (48”x48”x12”)	21 MPa (3,000 psi)	H12 at 150 mm (6”) spacing.
Pad footing on compacted granular soil. [200 kN/m2 (2 Tons/sq-ft)]	950 mm x 950 mm x 300 mm (39”x39”x12”)	21 MPa (3,000 psi)	H12 at 150 mm (6”) spacing.
Pad footing on rock. [450 kN/m2 (4.5 Tons/sq-ft)]	650 mm x 650 mm x 300 mm (27”x27”x12”)	21 MPa (3,000 psi)	H12 at 150 mm (6”) spacing.

NOTES:

1. The bearing capacities in Table 11 were used to determine the prescriptive footing sizes. Building of other soils will require engineering advice.
2. See Table 3 for equivalent cylinder strengths.
3. Equivalent Grade 60 rebar sizes in Table 4 may be used

4.4 COLUMNS

Columns are to have the size, strength, and reinforcement specified in Table 13 and arranged in Figure 18, which corresponds to the column height.

TABLE 13 - CONCRETE COLUMN SIZES AND REINFORCEMENT

Column Height	Minimum Size	Minimum Concrete 28-day compressive cube strength (Note 1)	Minimum Reinforcement (Note 2)
Less than 3.0m (10 ft) high.	200 mm x 200 mm	25 MPa (3,600 psi)	Main rebars: 4xH12 Links: H6 at 150 mm spacing.
3.0m (10 ft) to 3.65m (12 ft) high.	250 mm x 250 mm (10”x10”)	25 MPa (3,600 psi)	Main rebars: 4xH16 Links: H8 at 200 mm spacing.
3.65m (12 ft) to 4.3m (14 ft) high.	300 mm x 300 mm (12”x12”)	25 MPa (3,600 psi)	Main rebars: 4xH20 Links: H8 at 250 mm spacing.

NOTES:
1. See Table 3 for equivalent cylinder strengths.
2. Equivalent Grade 60 rebar sizes in Table 4 may be used.

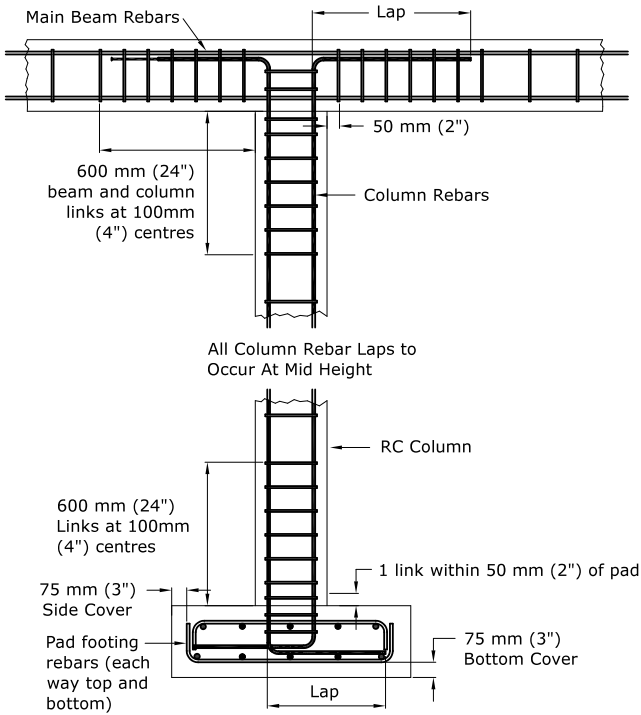


FIGURE 18 - RECOMMENDED DESIGN FOR PAD FOOTING AND COLUMNS

4.5 SLAB-ON-GROUND FOOTINGS

When good bearing soil is deep, then a slab-on-ground foundation can also be used (instead of columns), which integrates the footings into a ground floor slab supported on well compacted granular fill material. A slab-on-ground foundation can also be used on relatively flat land, where hard rock is close enough to the surface to allow the footings to be cast on the rock, or on compacted fill on the rock.

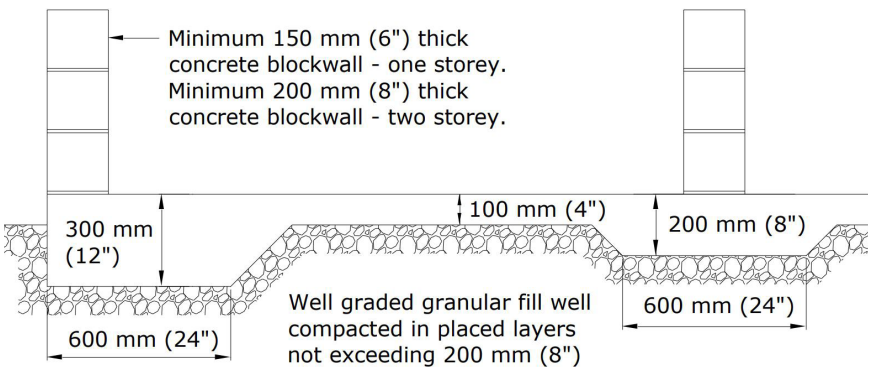


FIGURE 19 - LAYOUT OF SLAB-ON-GROUND FOOTING

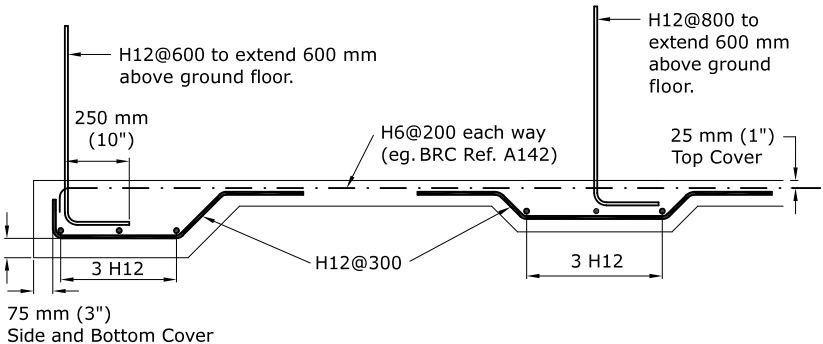


FIGURE 20 - REBAR LAYOUT OF SLAB-ON-GROUND FOOTING (MASONRY WALLS)

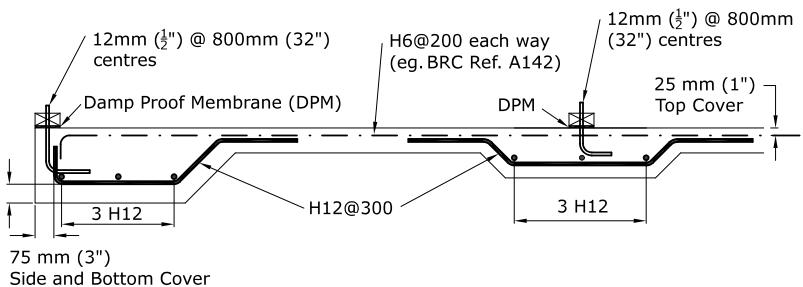


FIGURE 21 - LAYOUT OF SLAB ON GROUND FOOTING

Note: BRC Ref. A142 is a square mesh or 6 mm (1/4") rebar welded in a 200 mm (8") square pattern.

5.1 SUSPENDED REINFORCED CONCRETE FLOOR SLAB

Suspended reinforced concrete slabs are supported by reinforced concrete beams on: (i) strip footings, or (ii) columns.

Suspended reinforced concrete slabs (shown in Figure 24) should have the strength size and reinforcement as specified in Table 14, which corresponds to the span. These suspended slabs are applicable for floors and roofs.

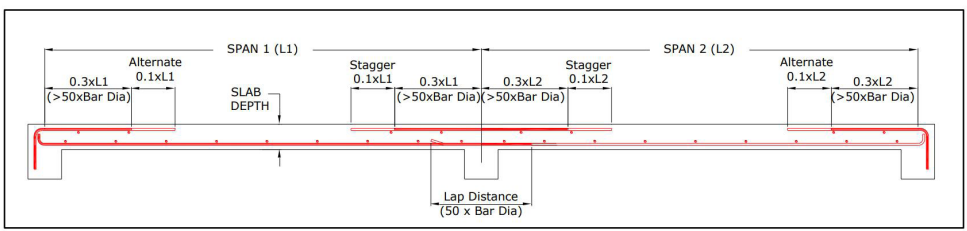


FIGURE 24 - SLAB REBAR LAYOUT

TABLE 14 - SLAB THICKNESS AND REINFORCEMENT (NOTES 1 TO 5)

Slab Thickness mm(inch)	Span Between Supporting Walls					
	1.8 m (6 ft)	2.4 m (8 ft)	3 m (10 ft)	3.6 m (12 ft)	4.3 m (14 ft)	4.8 m (16 ft)
100 (4”)	H12@300					
125 (5”)		H12@300	H12@300			
150 (6”)			H12@300	H12@300		
175 (7”)				H12@300	H12@250	
200 (8”)					H12@250	H12@200
225 (9”)						H12@200

NOTES:

1. Minimum secondary rebars to be H10 (3/8”) at 300 mm (12”) centres.
2. Use the thicker slab: (i) for higher than normal loads (eg. library, storage, home-gym), (ii) for stone floor tiles where smaller deflections (eg span/720) are required (eg porcelain), and/or to accommodate utility pipes, but engineering advice should be obtained for verification.
3. Concrete 28-day compressive cube strength to be 25 MPa (3,600 psi).
4. Equivalent Grade 60 rebar sizes in Table 4 may be used.
5. 300 mm (12”). 250 mm (10”), 200 mm (8”). H12 (1/2” diameter Grade 60 rebar).

5.2 CANTILEVERED REINFORCED CONCRETE SLAB

The main reinforcement in cantilevered reinforced concrete slabs (shown in Figure 26) should have the strength size and reinforcement as specified in Table 15, which corresponds to
the span.

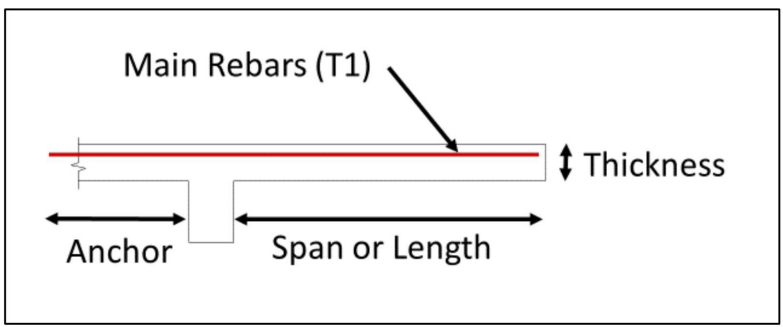


FIGURE 25 - CANTILEVER SLAB (ONLY MAIN REBARS SHOWN)

TABLE 15 - CANTILEVER SLAB THICKNESS AND REINFORCEMENT (NOTES 1 TO 6)				
Cantilever Slab Thickness mm (inch)	Cantilever span or length.			
	1.2 m (4 ft)	1.8 m (6 ft)	2.4 m (8 ft)	3.0 m (10 ft)
125 (5”)	H12@300			
150 (6”)	H12@300	H12@300		
150 (6”)		H12@300		
200 (8”)			H12@200	
200 (8”)			H12@200	H12@150
250 (8”)				H12@150

NOTES:

1. Minimum secondary rebars to be H10 (3/8”) at 300 mm (12”) centres.
2. Use the thicker slab: (i) for higher than normal loads (e.g., library, storage, home-gym), (ii) for stone floor tiles where smaller deflections (e.g., span/720) are required (e.g., porcelain), and/or to accommodate utility pipes, but civil engineering advice should be obtained for verification.
3. Concrete 28-day compressive cube strength to be 25 MPa (3,600 psi).
4. Minimum anchorage to be the greater of: (i) 1.5 x cantilever span, (ii) 0.3 x supported span, or (iii) 50 x bar diameter.
5. Equivalent Grade 60 rebar sizes in Table 4 may be used.
6. 300 mm (12”). 200 mm (8”). 150 mm (6”). H12 (1/2” diameter Grade 60 rebar).

5.3 SUSPENDED TIMBER FLOOR

Suspended timber floor joists are to have the sizes of Pine Structural Select (SS) and Purpleheart (Greenheart may also be used) as specified in Table 16 for 400 mm (16") spacing, and Table 17 for 600 mm (24") spacing.

TABLE 16 - TIMBER JOIST SIZES AT 400MM (16") SPACING

Span Range	Joist Size at 400mm centres	
	Pine SS	Purpleheart
1.5 m to 1.8 m (5 ft to 6 ft)	50 mm x 150 mm (2"x6")	50 mm x 100 mm (2"x4")
1.8 m to 2.4 m (6 ft to 8 ft)	50 mm x 200 mm (2"x8") or 75 mm x 150 mm (3"x6")	50 mm x 150 mm (2"x6")
2.4 m to 3.3 m (8 ft to 10 ft)	50 mm x 250 mm (2"x10") or 75 mm x 200 mm (3"x8")	50 mm x 200 mm (2"x8") or 75 mm x 150 mm (3"x6")
3.3 m to 3.6 m (10 ft to 12 ft)	75 mm x 200 mm (3"x8")	50 mm x 200 mm (2"x8")
3.6 m to 4.3 m (12 ft to 14 ft)	75 mm x 250 mm (3"x10")	50 mm x 250 mm (2"x10") or 75 mm x 200 mm (3"x8")
4.3 m to 4.8 m (14 ft to 16 ft)	75 mm x 300 mm (3"x12")	75 mm x 250 mm (3"x10")

TABLE 17 - TIMBER JOIST SIZES AT 600MM (24") SPACING		
Span Range	Joist Size at 600mm centres	
	Pine SS	Purpleheart
1.5 m to 1.8 m (5 ft to 6 ft)	50 mm x 150 mm (2"x6")	50 mm x 100 mm (2"x4")
1.8 m to 2.4 m (6 ft to 8 ft)	50 mm x 200 mm (2"x8") or 75 mm x 150 mm (3"x6")	50 mm x 150 mm (2"x6")
2.4 m to 3.3 m (8 ft to 10 ft)	75 mm x 200 mm (3"x8")	50 mm x 150 mm (2"x6")
3.3 m to 3.6 m (10 ft to 12 ft)	75 mm x 250 mm (3"x10")	50 mm x 200 mm (2"x8") or 75 mm x 150 mm (3"x6")
3.6 m to 4.3 m (12 ft to 14 ft)	75 mm x 300 mm (3"x12")	50 mm x 200 mm (2"x8") or 75 mm x 200 mm (3"x8")
4.3 m to 4.8 m (14 ft to 16 ft)	100 mm x 300 mm (4"x12")	50 mm x 250 mm (2"x10") or 75 mm x 200 mm (3"x8")

If the preferred size of timber joists are not available, then the joist's span may be reduced by installing a timber bearer beam on concrete or masonry piers (plinths), as shown in Figure 26. Fixings are to be No.12 wood grip screws in each hole of the connectors.

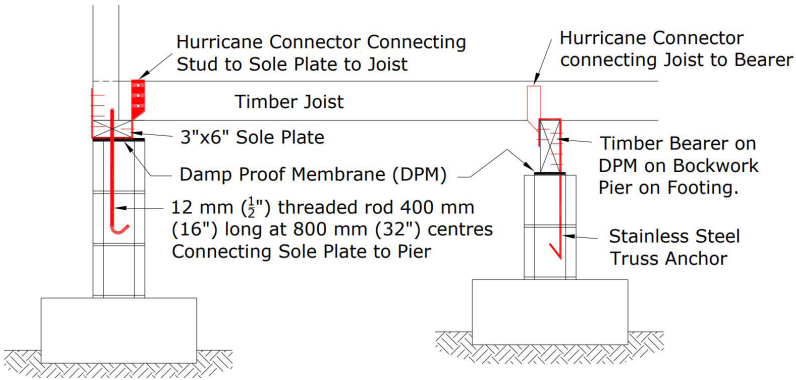


FIGURE 26 - TIMBER BEARER ON MASONRY PLINTH

TABLE 18 - STAIRS GEOMETRY			
Span	**A (m)**	**B (m)**	**Waist (mm)**
2.4 m (8')	0.7 m (28")	0.6 m (2')	125 mm (5")
3 m (10')	0.9 m (3')	0.6 m (2')	150 mm (6")
3.6 m (12')	1.1 m (3'-6")	0.6 m (2')	175 mm (7")
4.2 m (14')	1.3 m (4'-3")	0.65 m (26")	200 mm (8")

See Figure 28 overleaf

5.4 STAIRS

Reinforced concrete stairs are to have the geometry as shown in Figure 28 and Table 18, and the strength, and reinforcement as specified in Table 19, that corresponds to the span.

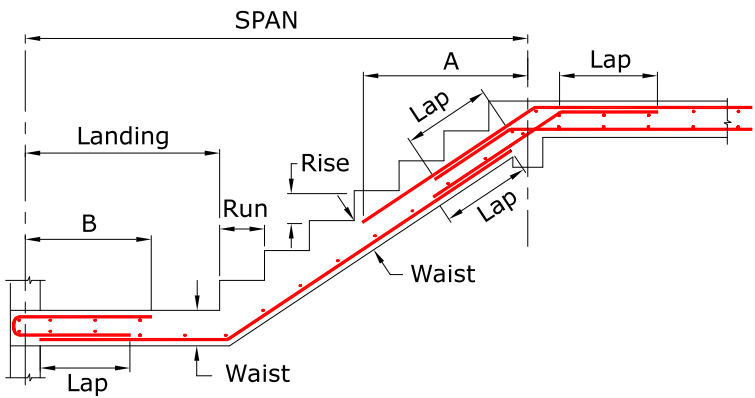


FIGURE 28 - STAIRS LAYOUT AND REBARS

TABLE 19 - SLAB THICKNESS AND REINFORCEMENT (NOTES 1 TO 5)						
Slab Thickness mm (inch)	Span Between Supporting Walls					
	1.8 m (6 ft)	2.4 m (8 ft)	3 m (10 ft)	3.6 m (12 ft)	4.3 m (14 ft)	4.8 m (16 ft)
100 (4”)	H12@300					
125 (5”)		H12@300	H12@300			
150 (6”)			H12@300	H12@300		
175 (7”)				H12@300	H12@250	
200 (8”)					H12@250	H12@200
225 (9”)						H12@200

NOTES:

1. Minimum secondary rebars to be H0 (3/8”) at 300 mm (12”) centres.
2. Use the thicker slab: (i) for higher than normal loads, (ii) for stone floor tiles where smaller deflections (e.g., span/720) are required (e.g., porcelain), and/or to accommodate utility pipes, but civil engineering advice should be obtained for verification.
3. Concrete 28-day compressive cube strength to be 25 MPa (3,600 psi).
4. Equivalent Grade 60 rebar sizes in Table 4 may be used.
5. 300 mm (12”). 250 mm (10”), 200 mm (8”). H12 (1/2” diameter Grade 60 rebar).

6.1 REINFORCED CONCRETE SUSPENDED BEAM SUPPORTING A MASONRY WALL

The components of a reinforced concrete suspended beam are shown in Figures 31 and 32. Reinforced concrete suspended beams are to have the strength, size, and reinforcement as specified in Table 21, that corresponds to the span.

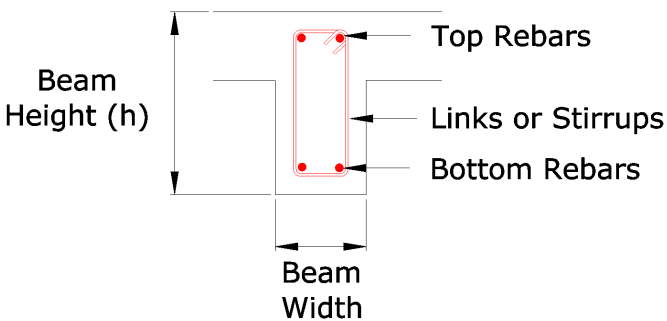


FIGURE 31 - REINFORCED CONCRETE SUSPENDED BEAM

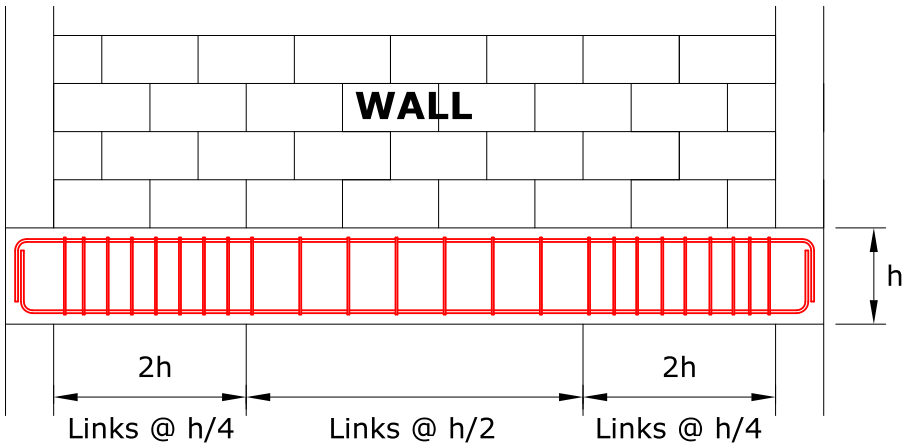


FIGURE 32 - LINK SPACING FOR REINFORCED CONCRETE SUSPENDED BEAM

TABLE 20 - BEAM SIZES AND REBARS (NOTES 1 TO 4)				
Maximum Span (m)	Minimum Depth (mm)	Top Rebars	Bottom Rebars	Links @ Spacing (mm)
2.4 m (8')	325 mm (13")	2H12 (1/2")	2H16 (5/8")	H8 (5/16") @150 (6")
3.0 m (10')	350 mm (14")	2H12 (1/2")	2H16 (5/8")	H8 (5/16") @150 (6")
3.6 m (12')	375 mm (15")	2H16 (5/8")	2H20 (3/4")	H8 (5/16") @200 (8")
4.3 m (14')	400 mm (16")	2H20 (5/8")	2H25 (1")	H8 (5/16") @200 (8")

NOTES:

1. Concrete 28-day compressive strength to be 25 MPa (3,600 psi).
2. If using less than the specified minimums, engineering advice should be obtained for verification.
3. Assumes beam supports a concrete block wall and part of the roof.
4. Equivalent Grade 60 rebar sizes in Table 4 may be used.

6.2 REINFORCED CONCRETE LINTEL BEAMS

Reinforced concrete lintel beams span small wall openings (e.g. doors, windows) and are to have the strength, size, and reinforcement as specified in Table 21, that corresponds to the span as shown in Figure 33.

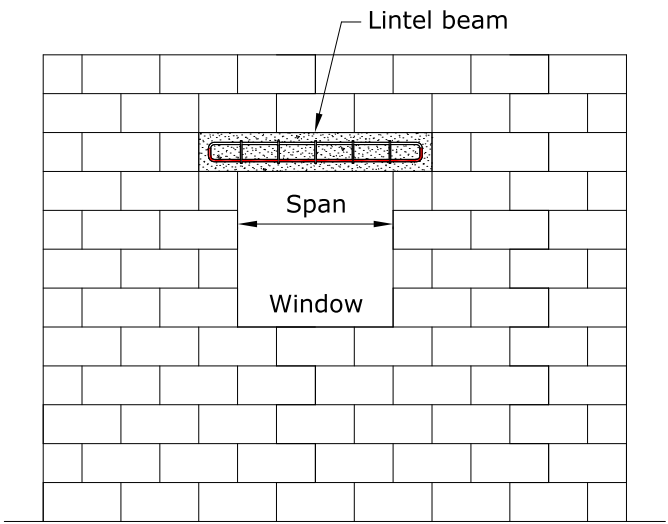


FIGURE 33 - LINTEL BEAM

TABLE 21 - LINTEL BEAM SIZES AND REBARS (NOTES 1 TO 3)			
Span of Lintel m (ft)	**Beam size (width x depth)**	**Main Rebar Number x Size**	**Links Dia @ mm centres**
Up to 1.0 m (0 to 3')	150x200 mm (6"x8")	4xH12 (1/2")	H8 (5/16") @150 mm (6")
1.0 to 1.8 m (3' to 6')	200x200 mm (8"x8")	4xH12	H8 (5/16") @150 mm (6")
1.8 to 2.4 m (6' to 8')	200x400 mm (8"x16")	2xH12 (1/2") (top) 2xH16 (5/8") (bottom)	H8 (5/16") @200 mm (8")

NOTES:

1. Concrete 28-day compressive cube strength to be 25 MPa (3,600 psi).
2. If using less than the specified minimums, engineering advice should be obtained for verification.
3. Equivalent Grade 60 rebar sizes in Table 4 may be used.

6.3 TIMBER WALLS

Timber walls are to be constructed of 2.4 m (8') high 50 mm x 100 mm (2"x4") timber studs. Pine SS (Structural Select) studs should be pressure-treated for termites and have a minimum spacing of 450 mm (18") on centre. Greenheart and Purpleheart studs should have a minimum spacing of 600 mm (24") on centre. Studs should be doubled at the wall's ends, tops and around openings, or the size should be 100 mm x 100 mm (4"x4"). A typical wall frame is shown in Figure 34. Wall cladding is specified in section 6.4.

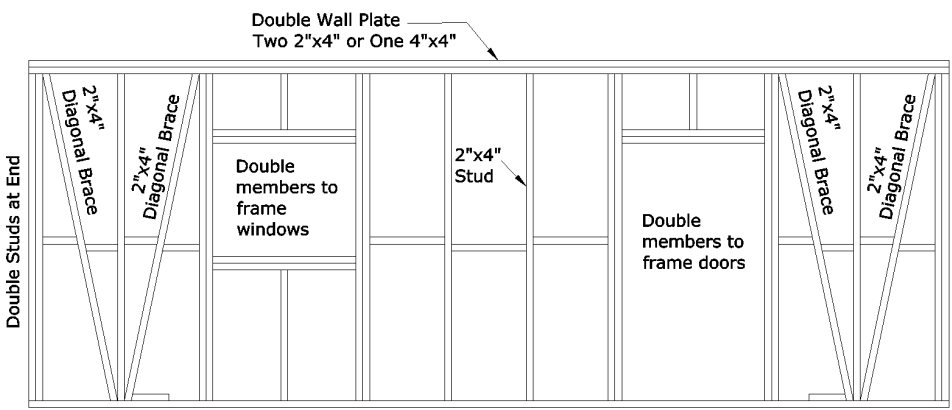


FIGURE 34 - LAYOUT OF WALL TIMBER FRAME

The frame should be connected together using nails or No. 12 wood grip screws embedded 40 mm (1.5”) into the connecting timber. It should also be reinforced with hurricane connectors (1 mm (0.04”) thick x 25 mm (1”) wide stainless steel or galvanised metal multi-purpose straps with 3.75 mm (0.15”) diameter galvanised nails. For each connector, a minimum of six nails should be installed on in each stud (3 each side). All wall junctions are to be braced as shown in Figure 35.

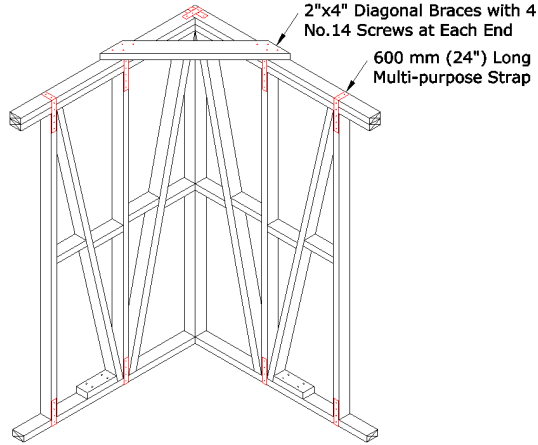


FIGURE 35 - TIMBER FRAME BRACING AT WALL JUNCTIONS

6.4 WALL CLADDING

Wall cladding for external walls should be: (i) 20 mm (3/4”) thick ship lap boards or (ii) 16 mm (5/8”) thick CDX plywood or equivalent. For internal walls, 12 mm (1/2”) thick CDX plywood or equivalent should be used. Wall cladding should be pressure-treated for termites and painted with a waterproof paint. The plywood should be fixed to the timber frame using 50 mm (2”) long No.12 wood grip screws at 300 mm (12”) spacing.

7 ROOF

This Guide specifies timber roof frames supported by:

(i) reinforced concrete beams on masonry walls, and
(ii) timber framed walls.

The roof consists of cladding, supported on purlins (battens) supported on plywood, which are then supported on rafters, which are then supported on walls. The purlins may be supported directly on the rafters as shown in Figure 38.

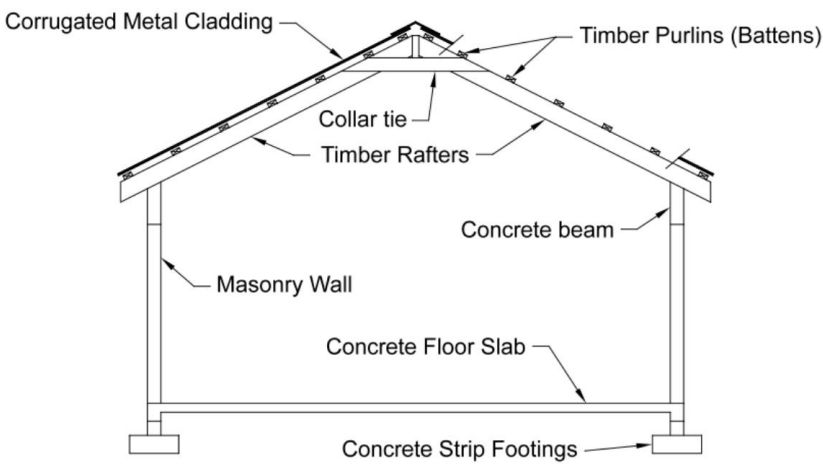
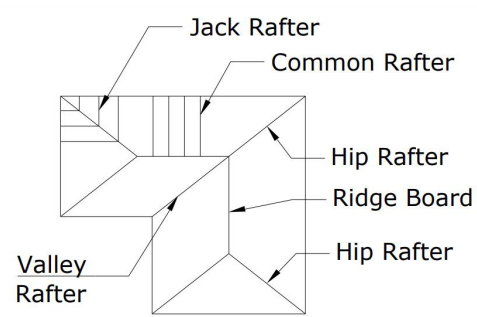


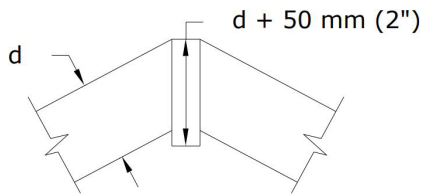
FIGURE 38 - SECTION THROUGH HOUSE SHOWING ROOF

7.1 RAFTERS

A description of the rafter types is shown in Figure 39.



Aim for a 30-degree (7 Vertical:12 Horizontal) roof pitch (slope).



Hip, valley and ridge members should be 50 mm deeper then common rafters.

FIGURE 39 - RAFTER TYPES

Main (common) timber rafters for hipped roofs are to have the strength size and spacing as specified in Tables 22 and 23 for Category 5 hurricanes, that corresponds to the rafter span. For comparison, common rafters specified for a Category 2 hurricane are shown. Hip, valley and ridge members should be 50 mm (2") deeper than the connecting rafters.

TABLE 22 - RAFTER SIZES AT 400MM (16") SPAN				
Span	Category 5 Hurricane		Category 2 Hurricane	
	Rafter Size at 400mm (16") centres		Rafter Size at 400mm (16") centres	
	Pine SS	Purpleheart	Pine SS	Purpleheart
1.5-1.8 m (5-6ft)	50x150 (2"x6")	50x100 (2"x4")	50x100 (2"x4")	50x100 (2"x4")
1.8-2.4m (6-8ft)	75x150 (3"x6")	50x150 (2"x6")	50x150 (2"x6")	50x100 (2"x4")
2.4-3.3 (8-10ft)	75x200 (3"x8")	75x150 (3"x6",) or 50x200 (2"x8")	50x150 (2"x6")	50x150 (2"x6")
3.3-3.6m (10-12')	75x200 (3"x8")	75x150 (3"x6",) or 50x200 (2"x8")	50x150 (2"x6")	50x150 (2"x6")
3.6-4.3m (12-14')	75x250 (3"x10")	50x200 (2"x8")	75x150 (3"x6")	50x150 (2"x6")
4.3-4.8m (14-16')	75x300 (3"x12")	75x200 (3"x8")	75x150 (3"x6")	50x150 (2"x6")

NOTE:
If using less than the specified minimums, engineering advice should be obtained for verification.

TABLE 23 - RAFTER SIZES AT 600MM (24") SPAN				
Span	Category 5 Hurricane		Category 2 Hurricane	
	Rafter Size at 600mm (24") centres		Rafter Size at 600mm (24") centres	
	Pine SS	Purpleheart	Pine SS	Purpleheart
1.5-1.8 m (5-6ft)	50x150 (2"x6")	50x100 (2"x4")	50x150 (2"x6")	50x100 (2"x4")
1.8-2.4m (6-8ft)	50x200 (2"x8")	50x150 (2"x6")	50x150 (2"x6")	50x150 (2"x6")
2.4-3.3 (8-10ft)	75x250 (3"x10")	75x150 (3"x6",) or 50x200 (2"x8")	75x150 (3"x6",) or 50x200 (2"x8")	50x150 (2"x6")
3.3-3.6m (10-12')	75x250 (3"x10")	75x200 (3"x8")	75x200 (3"x8")	50x150 (2"x6")
3.6-4.3m (12-14')	75x300 (3"x12")	75x200 (3"x8")	75x200 (3"x8")	75x150 (3"x6")
4.3-4.8m (14-16')	75x300 (3"x12")	75x250 (3"x10")	75x250mm (3"x10")	75x150 (3"x6")

NOTE:
If using less than the specified minimums, engineering advice should be obtained for verification.

7.1.1 REDUCING THE RAFTER'S SPAN.

Rafter sizes can be reduced by reducing the span by: (i) supporting the rafter on an internal wall, (ii) installing a 50 mm x 150 mm (2"x6") timber collar tie at a lower level (including making an A frame), and (iii) building a truss. Some reduced span concepts are shown in Figure 39. Connection details at the apex are shown in Figures 40 and 41.

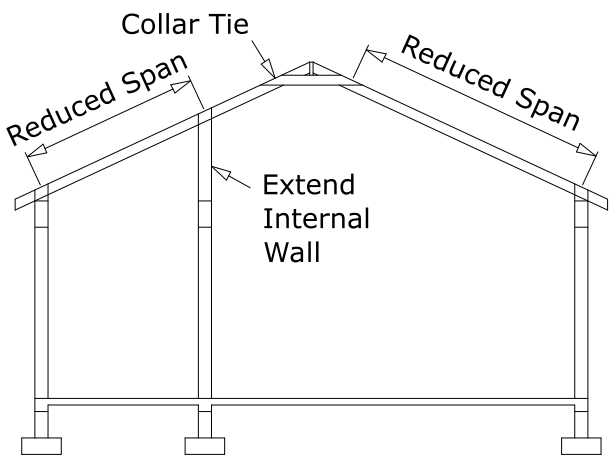


FIGURE 40 - SPAN REDUCING CONCEPTS

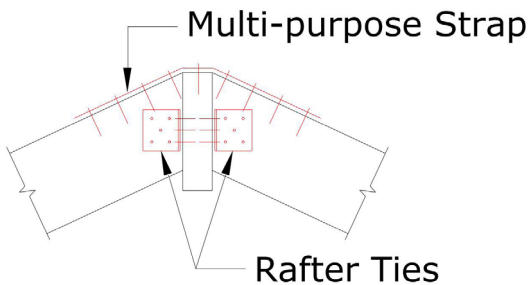


FIGURE 41 - RAFTER CONNECTIONS AT THE RIDGE

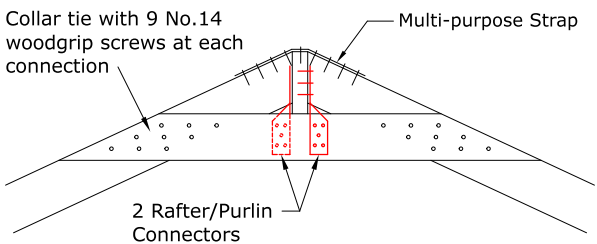


FIGURE 42 - COLLAR TIE AT RIDGE

The hurricane connectors should be minimum 1.0 mm thick (18 gauge) galvanised metal with a minimum tensile strength of 450 MPa.

7.2 RAFTERS ON MASONRY WALLS

The rafter to wall connection is shown in Figure 43.

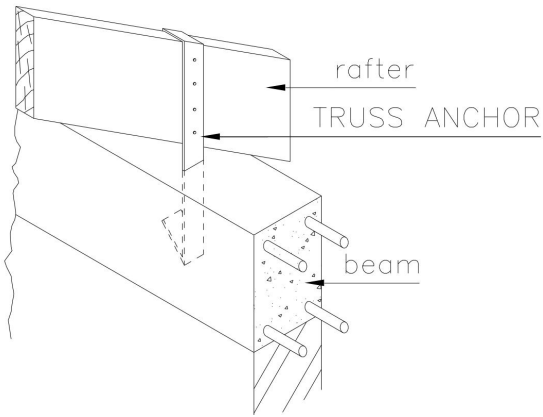


FIGURE 43 - RAFTERS ON MASONRY WALL (TWO TRUSS ANCHORS SHOULD BE USED FOR EACH RAFTER)

Truss anchors are to be 1 mm (0.04”) thick x 40 mm (1-9/16”) wide stainless steel or galvanised metal straps with 3.75 mm (0.15”) diameter galvanised nails.

7.3 RAFTERS ON TIMBER FRAMED WALLS

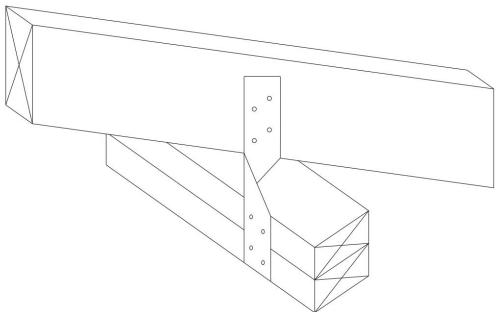


FIGURE 44 - RAFTERS ON TIMBER WALL
(TWO HURRICANE STRAPS SHOULD BE USED FOR EACH RAFTER)

Hurricane connectors are to be 1 mm (0.04") thick x 40 mm (1-9/16") wide stainless steel or galvanised metal straps with 3.75 mm (0.15") diameter galvanised screws.

7.4 PURLINS

The purlins (battens) are to be 50 mm x 100 mm (2"x4") treated Pine SS laid flat and spaced at 600 mm (24") for Category 5 hurricanes. The purlins may be supported on rafters, or on 16 mm (5/8") thick pressure treated CDX plywood which are then supported on rafters.
At each purlin rafter intersection, two No.12 screws are to be embedded 40 mm (1.5") into the rafter. All timbers are to be pressure-treated against termites.

7.5 CLADDING CONNECTIONS

The pattern of corrugated metal roof cladding connections is shown in Figure 45.

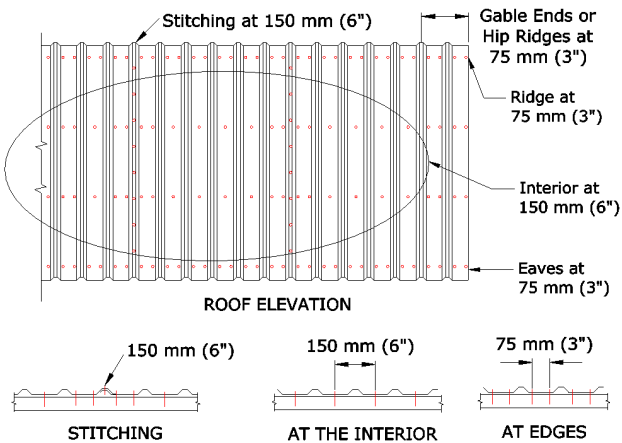


FIGURE 45 - ROOF CLADDING CONNECTIONS

8 CONCLUSION

This Pocket Guide provides tables and figures as an on-site reference aid for experienced construction supervisors to determine the sizes of construction elements.

Should any part of this Pocket Guide not be understood, the reader should refer to the explanatory information in the Learner's Guide for the Short Course Caribbean Vocational Qualification Occupational Standard: CCBCM30122 Level 3 - Construction Site Supervision.

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Pocket Guide to Construction Site Supervision of Houses

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