

**APPENDIX TO
NATIONAL DECREE CONTAINING GENERAL
MEASURES,
CONTAINING (CONSTRUCTION) TECHNICAL
REQUIREMENTS FOR CONSTRUCTION AND
DEMOLITION OF BUILDINGS
AS REFERRED TO IN ARTICLE 19 OF THE BUILDING
AND HOUSING ORDINANCE**

**PRACTICE GUIDELINE / CODE OF PRACTICE
BUILDING CLASS 0**

SINT MAARTEN

VERSION SEPTEMBER 2021

disclaimer

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PREFACE

This document is mainly based on the content of the former LB from 1935 Afdeling 1 (National Decree, Section 1) and the BES-code 2018 as far as the articles concern 'simple' buildings on Sint Eustatius and Saba. The BES-code regards the structural safety of buildings. The procedure to obtain a building permit requires structural design, calculations and drawings, but an alternative way to guarantee an acceptable level of safety is the compliance of detailed prescriptions. That is the current idea in the mentioned Afdeling 1. However, the damage caused by hurricane Irma on Sint Maarten and also on Saba and Statia was a signal, that the prescriptions for 'simple buildings' did not offer enough safety. The extra requirements for this category of buildings in the BES Code 2018 is in our opinion an adequate strengthening of the regulations.

Other than this Code of Practice, which is an obligatory type of legislation, the BES-code 2018 is a policy document for the application of the prescriptions in § 2.1 of the BES Building Decree on Bonaire, Sint Eustatius and Saba. The BES-code is edited by the engineers R. Sagel and A. Beukelman (IOB, Hellevoetsluis, NL), commissioned by the Ministry of the Interior and Kingdom Relations of the Netherlands, and contains a lot of other useful information regarding building in the Caribbean. A small part of the BES-code is copied from the Hurricane Resistant Construction Manual "Are you well connected" (Government of Montserrat). The initial edition is produced by ing. G.J. van Leeuwen, Xaro Consult (Velp) in cooperation with ir. P.A.J.A.T. Willemen, Gemeente Rotterdam, within the framework of the project Building Back Better II under responsibility of VNG International in The Hague.

Commissioned by VNG International and under the guidance of the latter expert, GeoDesign NV in Sint Maarten carried out random checks in 2020 on the largest possible structures imaginable within the definition of Building Class 0. The purpose of this was to be able to determine whether these structures are structurally safe. – when they are built in accordance with these Practical Guidelines – perform at least as equivalent as in accordance with the regulations in the National Decree, containing general measures on which it is based, indicated in articles 2.1 to 2.4 of that National Decree. The survey by GeoDesign gave no reason to amend this Practice Guideline.

In order to be able to continue the aforementioned method without involving a structural engineer, it is necessary that applicants for building permits for this type of construction keep their plans simple. However, if they do not want to or cannot opt for this approach because of their own ideas or the circumstances at the construction site, they must add extra information to their application, drawn up by a structural engineer. These components are specified and marked in color/grey in this Code of Practice. It is also possible that the applicants must regard their building plan as belonging to Construction Class 1 (or higher) as referred to in the National Building Decree, and then they must follow the regulations and procedures stated therein.

And last but not least; when the word National Decree is used hereinafter, this refers to the National Decree containing general measures with regard to technical regulations for the construction and demolition of structures as referred to in article 19 of the Building and Housing Ordinance, with the citation 'Building Decree'.

Section 1 General

Article 1.1 Scope

1. This code of practice is directed by the National Building Decree (NBD) for Sint Maarten under article 1.11. All buildings that belong to Building Class 0 as defined in article 1.6 and that are new to build or to change as mentioned in article 1.11 must be constructed exactly in accordance with the prescriptions given in this code of practice. This regards one storey buildings with a gross overall surface no more than 150 m² and the eaves no more than 3.50 m¹ above the ground floor level are classified as Building Class 0 buildings. An attic or mezzanine below a sloping roof with a slope between 26° and 35° and a free height of no more than 2,20 m¹ will not be considered as an extra storey.
2. For buildings other than mentioned in paragraph 1 this code of practice is not applicable and the requirements in the other articles of the National Building Decree must be complied with.
3.
 - a. In certain cases this code of practice requires for specified parts of a building design, structural calculations and drawings made by a structural engineer to be handed over to and to be approved by the Minister of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI), hereinafter the Minister, as part of the application of the permit.
 - b. Cases mentioned under a. are specified in this code of practice with a reference to this article. These references are marked in the same color as this paragraph.
 - c. The calculations and drawings mentioned under a. also shall regard – where relevant - the internal and external connections of the respective structural elements (such as anchorings, etc.)
4. Realization of the specified parts of a building mentioned in paragraph 3 is not allowed before the approval by the Minister is granted.

Article 1.2 Set of Guidelines

1. For support and visualization of this code of practice a preliminary set of guidelines is available for those who are involved as principal, builder, supplier, contractor or any other role in advice and realization of building in Building Class 0.
2. In case of doubt as to the application of the verbal or visual guidelines in comparison to this code of practice the Minister can be requested to give a binding opinion.

Section 2 Structural safety

Article 2.1 Loads on buildings

1. Point of departure for the prescriptions in this code of practice are:
 - a. The assumption for the ground floor load is 1.75 kN/m².
 - b. The assumption for wind loads regards buildings with a sloping roof, height 6 m¹.
2. If the load on the floor is higher than the value mentioned under paragraph 1.a. of this article, the prescription given by article 1.1, paragraphs 3. and 4. shall apply.

Article 2.2 Temperature – colors of cladding and roof

The range of temperature-fluctuations during the summer are mentioned in table 2.1.1 The bigger the difference are, the greater the effects of expanding and contraction building

materials, especially metal. In case of overlaying of several construction parts the dimension (length and width) of these must be reduced to prevent undesirable stress of materials, lack of water tightness etc.

TABLE 2.2.1

Situation	Temperature			
	Average maximum		Extreme	
	°C	°F	°C	°F
Summer – outside, non-direct sunlight	28	82.4	40	104
Direct sunlight - Very light colour ^a - Light colour ^b - Dark colour ^c	28	82.4	50	122
	28	82.4	60	140
	28	82.4	75	167
	28	82.4	75	167
Summer – inside	28	82.4	40	104
Winter – outside	n/a	n/a	n/a	n/a
Winter – inside	n/a	n/a	n/a	n/a
Constructions in the ground	22	71.6	22	71.6
^a White, light grey, yellow, cream ^b Ochre, beige, grey, green, pale blue ^c Black, blue, brown, red				

Article 2.3 Rainwater – design of emergency discharges

1. **Heavy rainfall** ($i_r = 0,140 \times 10^{-3} \text{ m/s}$) i_r = intensity of rain, the amount of rain falling on a horizontal surface, measured in meters per second.
The mentioned intensity is derived from the regularly rainfall on the Windward Islands. The Meteorological Service of Sint Maarten mentions 258 mm¹ as maximum precipitation during 24 hrs. In July 2005 in Cul-de-Sac a sudden rainstorm caused severe damage and even casualties. In that part of the island the rainfall was reportedly about 150 mm/hr (source: Z. Vojinovic, IHE-UN Delft).
 For light* roofs, awnings and terrace roofs, $\alpha < 15^\circ$:
 - a. Fall $\geq 3\%$ in direction of the spout.
 - b. Roof construction on rigid support points.
 - c. Deflection $\leq 0,004$ bearing length.
**) Such as wood, metal sheets, wooden shingles.*
2. **Rectangular emergency discharges**
 Rectangular emergency discharges with a height of $\geq 80 \text{ mm}^1$ are depending on the size of the discharge area according to Table 2.3.2.

TABLE 2.3.2 Rectangular emergency discharges with a height of $\geq 80 \text{ mm}^1$

Max. size discharge area m^2	Width of emergency discharge $\geq \text{mm}^1$
≤ 20	350
≤ 30	500
≤ 40	650

The available discharge area may also be divided (e.g. 40 m^2 into $2 \times 20 \text{ m}^2$) across several emergency discharges.

3. Round roof outlets

The internal middle line of a round roof outlet emergency discharges that passes vertically through the (roof) floor is depending on the size of the discharge area according to Table 2.3.3. with a minimum of 150 mm^1

TABLE 2.3.3

Max. size discharge area m^2	Internal middle line emergency overflow $\geq \text{mm}^1$
≤ 15	150
≤ 30	175
≤ 40	200

The available discharge area may also be divided (e.g. 40 m^2 into $2 \times 20 \text{ m}^2$) across multiple emergency discharges.

4. Other conditions to be satisfied:

- Each rainwater discharge area must be fitted with at least one emergency discharge.
- Number of emergency discharges ≥ 1 per 40 m^2 roof size discharge area. If emergency discharges discharge water from a higher roof onto a lower roof, these two roofs together form a single discharge area.
- If there is no fall between the emergency discharges towards the emergency discharge, the separation between the emergency discharges must be limited to 5 m^1 .
- All gutters must be watertight and made in such a way that no water can remain standing there, or can overflow.

Article 2.4 Measures regarding earthquake-risks

1. General

- The main purpose of these measurements is to create a ductile and connected structure, which is able to react and deform in case of an earthquake, without losing its bearing capacity.
- To deploy this capacity, special attention has to be given to the construction parts and connections.

2. Connections

- All connections should have a minimal bearing capacity.
- To connect all construction parts, each connection (as well as the construction part), should be designed with a minimum level of 150 kN shearing load.
- For constructions in reinforced concrete, the requirement under b. translates in 4 rebars $\varnothing 10$ or 1 $\varnothing 20$ in the middle, to maintain moment capacity.
- All rebars should be fully anchored.
- For steel structures a minimum of bolts can be determined.
- In masonry walls the anchoring of the roofs and from the foundation are prescribed further in this code of practice.

Article 2.5 Concrete and reinforcement

- To guarantee the cracking behavior of the concrete structure as a whole or of the individual construction elements, the following requirements are imposed on the reinforcement in the concrete structure:
 - Stirrup shapes:**

The anchoring of practical stirrups and shear force and/or torsion stirrups should be achieved by bending the stirrups themselves at right angles, or using hooks as shown in figure 2.5.1f and g.
 - The principle for the overlap length and the anchoring length of the reinforcement subject to tensile and compressive force, steel type B 500.
 - Good bond (figure 2.5.1a and b):
Concrete C 16/20 $\geq 50 \varnothing$; concrete C 20/25 $\geq 40 \varnothing$.
 - Poor bond (figure 2.5.1c and d):
Concrete C 16/20 $\geq 60 \varnothing$; concrete C 20/25 $\geq 50 \varnothing$.

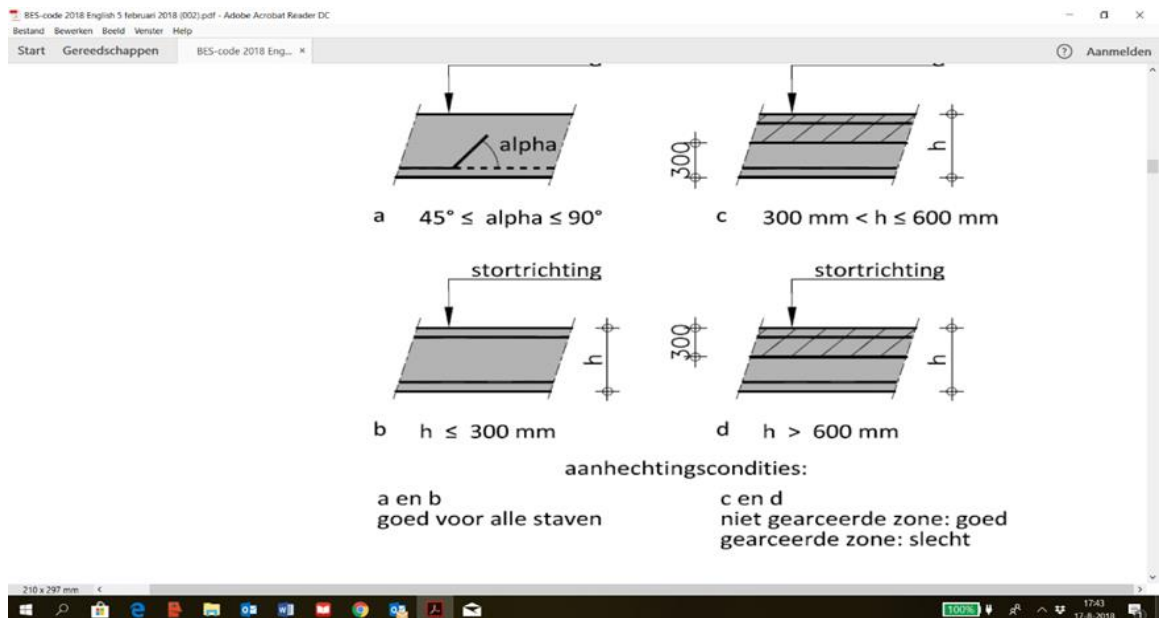
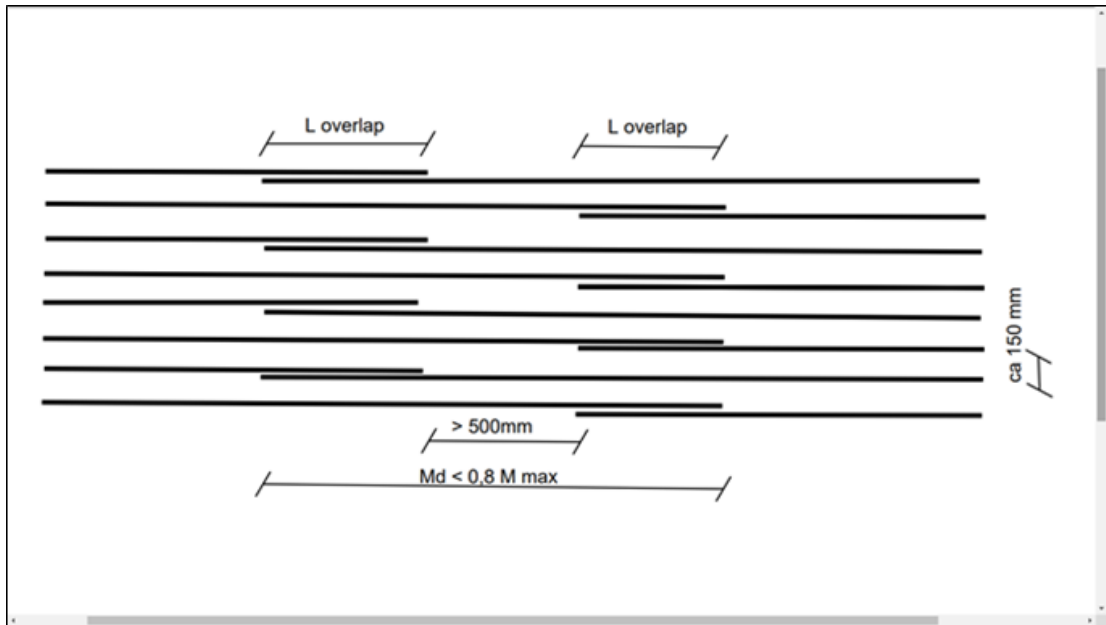


Fig. >
2.5.1a-d

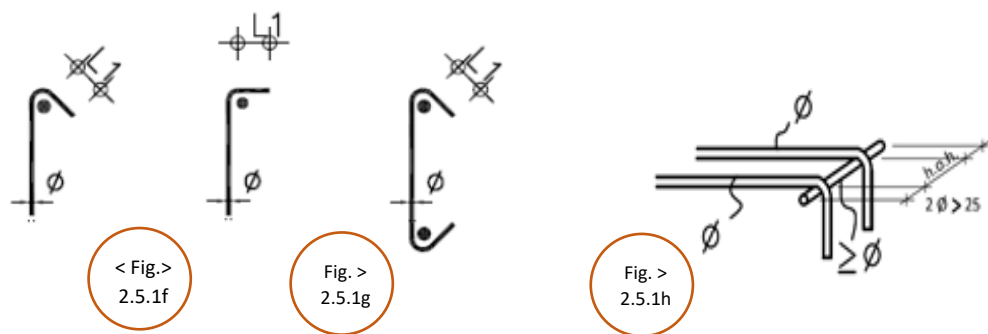
'stortrichting' = pouring direction, a and b good for all bars, c and d: not hatched zone = good, hatched zone = poor

- c. Overlaps in beams and slabs should be staggered (figure 2.5.1e), with a centre-to-centre separation between two overlaps $\geq 150 \text{ mm}^1$ or $10 \phi_{\text{rbar}}$, only in parts of the beam or slab where the moment $M_d \leq 0,8 M_{\text{max}}$.
- d. No overlaps where forces are at a maximum, like maximum bending moment, center span, (80% -100% area)



< Fig.
2.5.1e

- e. The center-to-center separation between the reinforcement bars the following may be maintained for beams and columns that form part of (confined) masonry walls:
 - I. The center-to-center separation with the (flank) bars $\leq 350 \text{ mm}^1$.
 - II. Stirrups and 'S-hooks' with a center-to-center separation $\leq 350 \text{ mm}^1$.
- f. For anchoring length of reinforcing steel the following must be assumed:
 - I. Tension member with a hook, according to figure 2.5.1f: for basic anchoring length l_{vo} , $0,7 l_{vo}$ must be maintained if the if the cover around the tension member $\geq 3 \phi_{\text{tension member}}$.
 - II. For angled hooks on stirrups, the length must be $L1 = 5 \phi \geq 50 \text{ mm}^1$. For right-angled hooks (90°) $L1 = 10 \phi \geq 70 \text{ mm}^1$.
 - III. Within the bent-over section of the bar subject to tensile loading $\geq \phi 16$, a lateral bar with a diameter $\geq \phi_{\text{tension member}}$ must be inserted. Length of the lateral bar, see figure 2.5.1h. The lateral bar must be supported by at least two tension members.



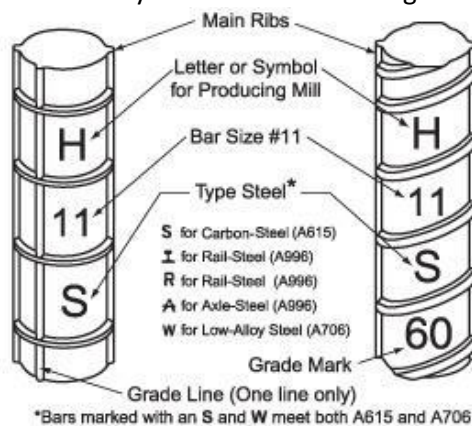
Article 2.6 Reinforcing steel

1. Reinforcement generally applicable for Sint Maarten

- The construction of a building must be designed in such a way that 'brittle' failure of the construction as a whole or as the individual construction elements is avoided.
- To guarantee the subsequent crack behaviour of the (concrete) construction as a whole or of the individual construction elements, the following requirements are imposed on the reinforcement of the concrete structure:
- Smooth reinforcing steel is not permitted.
- Reinforcing steel with a carbon content $C > 0,22 \%$ is not permitted (too brittle).
Nevertheless, by the applicant desired application of steel grades mentioned under c. and d. falls under Building Class 1 (BC1).

2. Grade 60

Grade 60 may be used as reinforcing steel.



GRADE 60

The reinforcing steel must be accompanied with a (factory) certificate belonging with the batch of reinforcing steel. If not, American ribbed reinforcement could be used as Grade 60. Grade 60 is reinforcing steel which is traditionally used in fabric mesh reinforcement with a characteristic value for the yield point.

Article 2.7 Soil investigation and soil improvement

1. Soil investigation

With a (restricted) soil investigation, the depth at which the supporting soil layer is located can be identified. If this layer is at greater depth, the obvious choice is a spud foundation for which advice by a structural engineer is necessary. This means the prescription given by article 1.1, paragraphs 3. and 4. shall apply for the foundation.

2. Foundation on rock or solid limestone (adamantine)

Rock can be viewed as a collective term for different rock formations. On Sint Maarten, for example the following formations are known:

- a. *Volcanic rock*: hard rock consists partially of basalt. Occurs throughout on the various hill ridges.
- b. *Adamantine*: hard limestone, must be viewed in terms of hardness as rock:
- c. *Porous adamantine*: in terms of hardness must be viewed as soft rock.
- d. *Chunks of broken adamantine mixed with sand or clay*: if well compacted, in terms of hardness must be seen as a rigid soil profile.
Adamantine is a coral limestone rock. Depending on where it is found it can range in hardness from soft rock to hard rock. It must be broken to be removed. The problem with this rock type is that although it is suitable for use as foundation, following further soil investigation, holes/cavities can be discovered. These holes must be filled with grout or weak-mix concrete.
The question then also emerges whether the layer of adamantine above these cavities is thick enough to serve as a foundation, certainly in the case of higher foundation forces. Certainly with higher foundation forces, when using adamantine as foundation, care is advised (soil mechanical advice is required; this means the prescription given by article 1.1, paragraphs 3. and 4. shall apply).
- e. *Caliche*: a hard stony-like mixture of calcium carbonate. Contains sand, gravel, clay and salt. In terms of hardness must be viewed as rigid soil profile.
- f. *Diabase soil*: a sand-clay mixture. In terms of hardness, if well compacted must be seen as rigid soil profile.
- g. *Sand*: Fine sediment. If well compacted, in terms of hardness must be seen as a rigid soil profile.

3. Excavation

- a. In the case of foundation on rock, any loose rock must first be removed. The rock should then be horizontally levelled to the required level.
- b. In the case of buildings placed on a slope, the rock must be horizontally excavated (possibly stepped) over the width of the foundation strips.
- c. In the case of foundation strips perpendicular to the slope, the rock must be excavated stepped. On each step, a horizontal foundation level should be produced, to prevent slipping down the slope.

4. Foundation on supporting soil layer Excavation

- a. If the foundation is placed on a natural soil layer, e.g. diabase soil whether or not mixed with broken limestone rock, or caliche, the soil from the trench or excavation must be dug out to the required level, and then mechanically compacted.

- b. If the foundation is placed on a supporting clay layer, the final 0,1 m¹ must be carefully horizontally scraped, so that the clay below the excavation level is not disturbed or is disturbed as little as possible.
- c. In the case of buildings placed on a slope, the non-supporting soil layer must be excavated horizontally across the width of the foundation (possibly stepped).
- d. In the case of foundation strips perpendicular to the slope, the non-supporting soil layer must be excavated stepped. At each step, a horizontal foundation level should be produced, to prevent slipping down the slope.
- e. To prevent softening on the soil layer by precipitation, a supporting sand layer or similar layer of $\geq 0,1 \text{ m}^1$ must be applied to the top of the soil, immediately following excavation.
- f. In the case of foundations on a deeper supporting soil layer, the non-supporting soil must be excavated (method as described above) and refilled with soil improvement.

5. **Applying soil improvement**

- a. Replace bad soil or other unwanted inclusions.
- b. The soil improvement must cover an area at least equivalent to the area in which the load is spread at an angle of 45°.
- c. The soil improvement/backfill, e.g. diabase, crushed sand, stabilized (non-salt bearing) sand (6-8 parts sand : 1 part cement) must be applied across the entire excavation area.
- d. The backfill should be compacted layer by layer according to the following instructions:
 - I. The bed of the trench or excavation must be dry. If necessary compact the trench or excavation on which the soil improvement is placed.
 - II. If the width of the backfill $\leq 0,6 \text{ m}^1$, the layer thickness for compacting should be $\leq 0,1 \text{ m}^1$
 - III. If the width $\geq 1,0 \text{ m}^1$, the layer thickness should be $\leq 0,3 \text{ m}^1$. Straight-line interpolation is permitted for intermediate values.
 - IV. Around and inside the foundation, the excavation should be backfilled with diabase, up to the underside of the ground floor.
 - V. Each separate layer should be watered in and (mechanically) compacted before the next layer is applied.
 - VI. In the case of buildings placed on a slope, it may be necessary to apply the backfill stepped. In each step a horizontal foundation level should be produced to prevent slipping down the slope.
 - VII. After the soil improvement has been applied, it is permitted to dig narrow trenches for installing pipelines; the installation of pipelines below large line loads such as 6" masonry walls is advised against; disturbed soil. These pipelines should preferably be installed $\geq 250 \text{ mm}^1$ adjacent to this line load (no disturbed soil within $\approx 60^\circ$ spread adjacent to the line load).
 - VIII. Once the soil improvement has been applied, it is permitted to dig trenches for sheet strengthening. The disturbed soil in the trenches should then be compacted.
 - IX. Anti-termite treatment must be carried out around and within the foundation.
 - X. In the case of foundation on a deeper supporting soil layer, the non-supporting soil should be excavated (method as described above) and

- backfilled with soil improvement.
- XI. In the case of buildings placed on a slope, the non-supporting soil layer must be removed horizontally across the width of the foundation strips (e.g. stepped).
- XII. In the case of foundation strips perpendicular to the slope, the non-supporting soil layer must be removed, stepped. At each step, a horizontal foundation level should be produced, to prevent sliding forces down the slope.

6. **Concrete bed**

- a. The concrete bed below the floor consists of:
 - I. Tamped concrete 50 mm¹ thick.
 - II. Hard plastic film. Select spacers below the reinforcement which do not penetrate the plastic when walking on the reinforcement.
 - III. The concrete bed at (edge) beams and reinforced strips consists of 50 mm¹ thick tamped concrete.
- b. During concrete pouring, the bed of the trench or excavation must be dry, to prevent the leaching of concrete or binding agent.
- c. In the case of a supporting soil layer, applied according to the method described in this section a rigid soil profile will be assumed.

Article 2.8 Foundations

1. **Shallow foundations**

- a. *Strip foundation*
 - I. The supporting soil layer is produced in the manner described in article 2.7.
 - II. All outer walls and the load-bearing inner walls located between the foundation strip and the ground floor must at least be produced in:
 - A. Confined masonry (figure 2.8.1b) with a height ≤ 1200 mm¹, 6 seams.
 - B. If circumstances (slope, size of the building) leads to masonry with a height > 1200 mm¹, a sheet foundation (paragraph 2) might be a solution. Otherwise a structural engineer must be involved under the requirement of article 1.1, paragraphs 3 and 4. *The masonry height constraints are included to prevent failure of the wall due to high horizontal load pressure on the outside.*
 - III. The masonry between the ground floor and the foundation strip must be executed in ≥ 6 "hollow blocks".

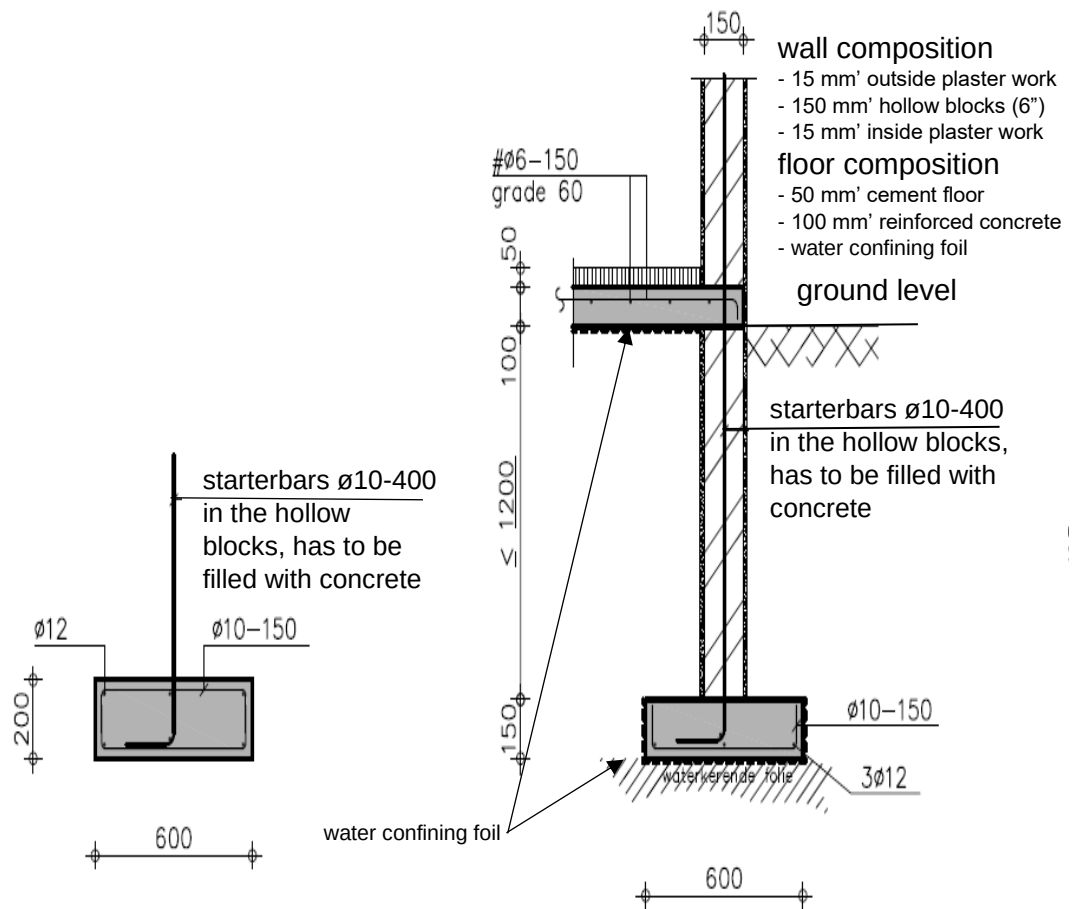


Figure 2.8.1a

Figure 2.8.1b

- IV. It may be executed in:
- Confined masonry (figure 2.8.1.c) with a height $\leq 1200 \text{ mm}^1$, 6 seams.
 - All outer walls, height masonry $> 1200 \text{ mm}^1$ (6 seams), between the foundation slope and the ground floor must be fitted with a ring beam $150 \times 400 \text{ mm}^2$ as drawn in figure 2.8.1.b.
- V. The starterbars Ø 10 – 400 ($\frac{3}{8}'' - 400$) from the slope must continue till $\geq 50 \text{ Ø} = \geq 500 \text{ mm}^1$ above the ring beam and anchored in the with concrete filled hollow blocks.
- Purpose of the starting bars: when blocks are directly set on the concrete strip the adhesion between blocks and concrete is too low to transfer this loads out of the earthquake. That's why in the adhesion area between concrete and hollow blocks extra starterbars Ø 10 – 400 must be placed: The hollow space in the blocks must be filled with concrete.*
- VI. The placement of the ground floor between the foundation walls is not permitted. So: floor ON the foundation walls, not next to it. The reinforcement of the floor slab is as article 2.6. paragraph 2
- VII. The dimensions of the foundation strip with the associated reinforcement and concrete class must satisfy to the following VIII and IX, unless determined by calculation. In case of calculation a structural engineer must be involved

under the requirements of article 1.1, paragraphs 3 and 4.

VIII. *Dimensions:*

- A. For non-loadbearing and loadbearing inner- and outer walls thickness $\geq 150 \text{ mm}^1$ (6") in single storey building: width $\geq 600 \text{ mm}^1$, height $\geq 150 \text{ mm}^1$
- B. For loadbearing inner- and outer walls thickness $\geq 150 \text{ mm}^1$ (6 ") in single-layer construction with a concrete roof: width $\geq 600 \text{ mm}^1$, height $\geq 200 \text{ mm}^1$ (figure 2.8.1a).
- C. The width of the foundation must be increased in case of a foundation on clay ground f.i. 700 mm^1 , height $\geq 150 \text{ mm}^1$.

IX. *Reinforcement strip foundation thickness 150 mm^1 :*

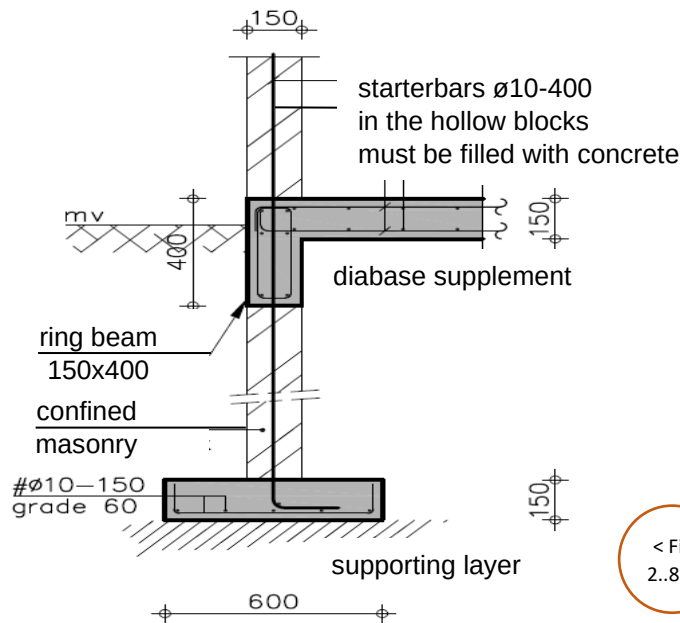
- A. Main reinforcement $\geq \emptyset 10 - 150$ (B 500 A), or Grade 60: $\frac{3}{8}" - 150$ ($\emptyset 10 - 150$). Reinforcement preferably raised at least 90 mm^1 along the edges.
- B. Distribution reinforcement $\geq 3 \times \frac{1}{2}"$ ($3 \emptyset 12$) (figure 2.8.1b) or $\frac{3}{8}" - 250$ ($\emptyset 10 - 250$).
- C. Starterbars $\emptyset 10 - 400$ ($\frac{3}{8}" - 400$).
- D. Concrete strength class $\geq \text{C } 16/20$ (B 20).
- F. Concrete cover $30 + 5 = 35 \text{ mm}^1$.

b. *Possible alternative application:*

- I. Fabric mesh (Grade 60) # $\emptyset 10 - 150$ for strip foundation below (non) loadbearing inner walls in single storey building. Reinforcement preferably raised at least 90 mm^1 along the edges.
- II. Incorporate starter bars $\emptyset 10 - 400$ ($\frac{3}{8}" - 400$) in block filling to $\geq 500 \text{ mm}^1$ above the ground floor. Preference to roughen the masonry/concrete interface (adhesion).
- III. Concrete strength class $\geq \text{C } 16/20$ (B20).
- IV. Concrete cover $30 + 5 = 35 \text{ mm}^1$.

c. *Strip foundation for buildings placed on a slope; angle of inclination $\leq 15^\circ$*

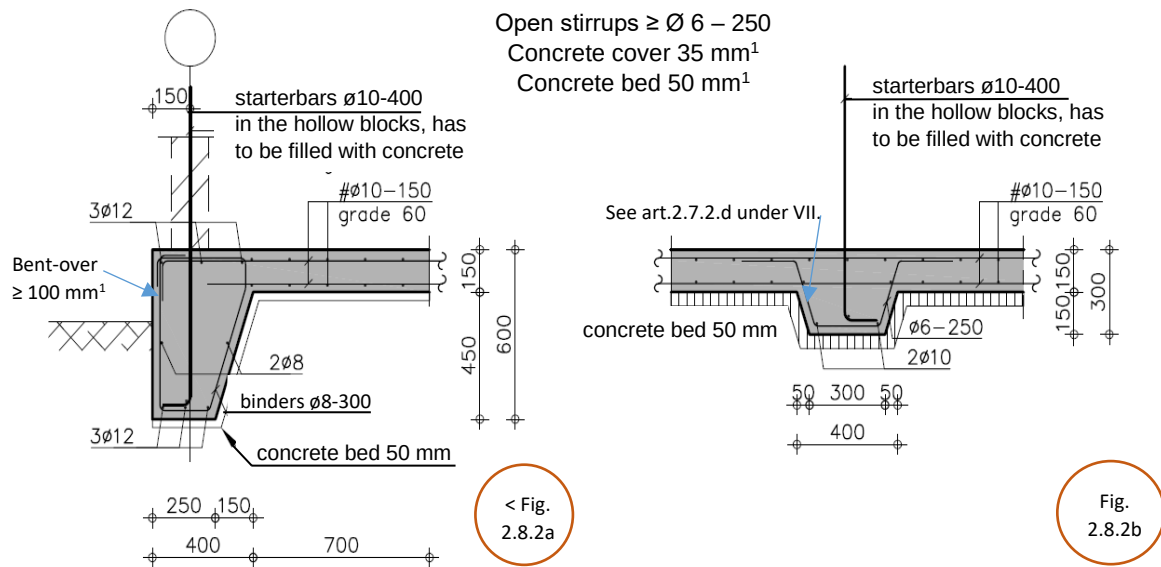
- I. With foundation strips perpendicular to the slope, the foundation strip should be fitted in stepped sections. On each occasion, a horizontal foundation level should be produced, to prevent the foundation slipping down the slope. Dimensions and reinforcement see paragraph a. under V.
- II. If a building is placed on a slope, angle of inclination $> 15^\circ$, with unsupported foundation walls with a height $> 2,0 \text{ m}^1$ (height from the top of the ground floor to the top of the foundation strip), the dimensions and the reinforcement of the support structure must be determined by the structural engineer according to the requirements of article 1.1, paragraphs 3 and 4.



2. Sheet foundation

- a. A supporting soil layer must be achieved in accordance with the provisions in article 2.7.
- b. The dimensions of the concrete sheet foundation with the associated reinforcement must at least satisfy the following, *unless determined by calculation*: **In case of calculation a structural engineer must be involved under the requirements of article 1.1, paragraphs 3 and 4.**
 - I. Thickness of sheet foundation $\geq 150 \text{ mm}^1$, on the outside always fitted with an edge beam. Bottom of edge beam $\geq 400 \text{ mm}^1$ below ground level, with a width at the bottom of 250 mm^1 and at the top (against the bottom of the floor) 400 mm^1 (figure 2.8.2a+b).
 - II. Below the load-bearing inner walls and other heavy load strips, with a floor thickness of 150 mm^1 , a 300 mm^1 wide floor strengthening, with a height of $\geq 150 \text{ mm}^1$, possibly with 50 mm^1 sloping sides met een hoogte van $> 150 \text{ mm}$, must be fitted (figure 2.8.2b).
 - III. Concrete strength class $\geq \text{C } 16/20 \text{ (B20)}$.
 - IV. Concrete cover floor environmental class XS 1: under $30 + 5 = 35 \text{ mm}^1$, at the top 30 mm^1 .
 - VI. Concrete cover beam environmental class XS 1: under $35 + 5 = 40 \text{ mm}^1$.
 - VII. Top of the ground floor $\geq 100 \text{ mm}^1$, preferably $\geq 200 \text{ mm}^1$, above street level (because of possible flooding).
 - VIII. Light non load-bearing partition walls with a weight $\leq 1 \text{ kN/m}^1$ can be placed directly on the floor (without recalculation).
 - IX. Floor reinforcement in accordance with paragraph 2.8.2 under c. When calculation are being made then they must be executed by an engineer as determined in art. 1.1 paragraph 3 and 4.

Note: Given the limited height of the edge beams, measures must be taken to prevent the sand layer being washed out from beneath the sheet foundation in the event of heavy rainfall.



c. Floor reinforcement:

- I. Floor thickness 150 mm¹:
 - A. Top and bottom reinforcement B 500: $\text{Ø } 10 - 200$, or Grade 60 # $\text{Ø } \frac{3}{8}'' - 150$, (figure 2.8.2a).
 - B. Starterbars $\text{Ø } 10 - 400$ ($\text{Ø } \frac{3}{8}'' - 400$) rebar length $\geq 500 \text{ mm}^1$ placed in the blocks (figure 2.8.2b). The hollow space in the blocks has to be filled with concrete.
- II. In heavy load-bearing floors: sheet thickness 200 mm¹:
Top and bottom reinforcement $\geq \text{B } 500$: $\text{Ø } 10 - 125$, or: Grade 60 # $\text{Ø } \frac{3}{8}'' - 100$.
- III. Concrete strength class $\geq \text{C } 16/20$ (B20).
- IV. Concrete cover floor:
 - A. Bottom: environmental class XS 1 uncontrollable: $30 + 5 = 35 \text{ mm}^1$.
 - B. Top: environmental class XS 1: 30 mm^1 .
- V. Edge beam: Concrete cover: XS 1: 35 mm^1 , under $35 + 5 = 40 \text{ mm}^1$; XS 2 and XS 3: 40 mm^1 .
- VI. The top reinforcement must be bent over at least 100 mm^1 into the edge beams.

Note!! The tensile stress in the floor is caused by the heavy masonry walls on the edge beams, on the top of the floor. A top net must therefore always also be applied. Make a minimum of 700 mm in the bottom net anchored in the edge beam (figure 4.8.2a).

- VII. Around the floor strengthening, a bottom mesh (as wide as the strip width + $2 \times 500 \text{ mm}^1$) in the floor is recommended to help spread the load and to prevent cracking.

d. Reinforcement edge beam (ductility class A)

- I. Bottom + top $\geq 500 \text{ mm}^2$ ($2 \times 3 \text{ Ø } 12$, 679 mm^2) at the ends with a bent-over end $\geq 300 \text{ mm}^1$.
- II. Stirrups $\text{Ø } 8 - 300$, or $\text{Ø } 6 - 250$.
- III. Starterbars $\text{Ø } 10 - 400$ ($\text{Ø } \frac{3}{8}'' - 400$) rebar length $\geq 500 \text{ mm}^1$ in the hollow blocks filled with concrete (figure 2.8.2a+b).
- IV. Concrete cover beam $35 + 5 = 40 \text{ mm}^1$.

f. Reinforcement floor strengthening (ductility class A):

- I. Bottom 2 $\emptyset$ 10 or 3 $\emptyset$ 8, at the ends with bent-over end $\geq 300 \text{ mm}^1$.
- II. Open stirrups $\geq \emptyset$ 6 – 250 ($\frac{1}{4}''$ – 250) Concrete cover $35 + 5 = 40 \text{ mm}^1$.
- III. Starterbars $\emptyset$ 10 – 400 ($\emptyset \frac{3}{8}''$ – 400) rebar length $\geq 500 \text{ mm}^1$ in the hollow blocks filled with concrete (figure 2.8.2b).

3. **Example of alternative sheet foundation:**

- a. Edge beams $250 \times 600 \text{ mm}^2$ (reinforcement bottom + top $\geq 3 \emptyset$ 12 (3 $\emptyset \frac{1}{2}''$), stirrups $\emptyset \frac{1}{4}''$ – 300 + starterbars $\emptyset$ 10 – 400 ($\emptyset \frac{3}{8}''$ – 400) rebar length $\geq 500 \text{ mm}^1$ in the hollow blocks filled with concrete (figure 2.8.2a). Concrete cover beam $35 + 5 = 40 \text{ mm}^1$.
- b. Floor 150 mm^1 . Reinforcement bottom and top Grade 60: # $\emptyset \frac{3}{8}''$ – 150 + starterbars $\emptyset$ 10 – 400 ($\emptyset \frac{3}{8}''$ – 400) rebar length $\geq 500 \text{ mm}^1$ in the hollow blocks filled with concrete (figure 2.8.2a+b).
- c. Concrete cover floor $30 + 5 = 35 \text{ mm}^1$.
- d. At the position of the line loads, if necessary, use additional reinforcement.

Note: Given the limited height of the edge beams, measures must be taken to prevent the and layer being washed out from beneath the sheet foundation in the event of heavy rainfall.

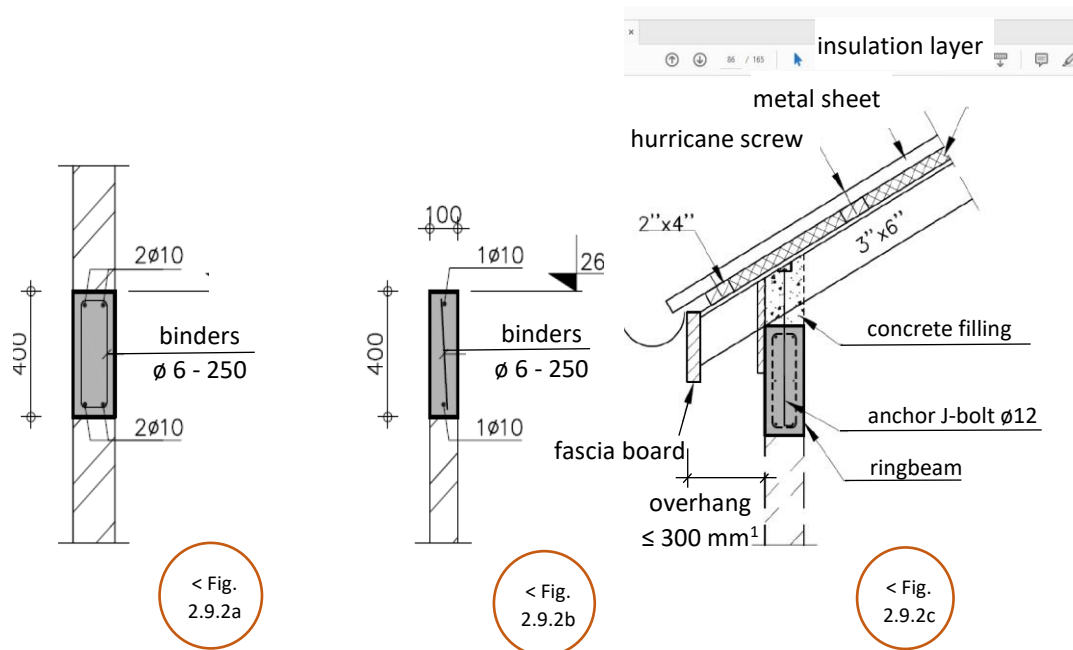
Article 2.9 Wall-constructions

1. **General rules regarding walls, columns and beams**

Walls made of confined masonry, reinforced masonry and timber are usual in small and simple buildings. Because of the occurrence of earthquakes in the Caribbean non-reinforced non-confined masonry walls are not allowed in BCQ on Sint Maarten. (Confined: masonry forming a 'disc' together with a surrounding frame of reinforced columns and beams. Reinforced: hollow blocks filled with reinforced concrete.)

2 **Masonry walls**

- a. Masonry walls are usually made of hollow blocks, 6" or 8" thick, 200 mm^1 high.
- b. All masonry works must be carried out using a mortar consisting of 1 part of cement on 4 parts of sand.
- c. The following additional conditions apply :
Because of the instability of $< 6''$ masonry walls during an earthquake all masonry walls must be $\geq 6''$ (150 mm^1).
- d. All outer walls and the load-bearing inner walls located between the foundation strip and the ground floor must be produced in confined masonry:
 - I. Masonry, thick $\geq 150 \text{ mm}^1$, 6" blocks,
 - II. Enclosed by a ring beam and centre-to-centre separation $\leq 4 \text{ m}^1$ by concrete columns.
 - III. The ring beam must form a single complete disc, with the enclosed masonry.
- e. The placement of the ground floor between the foundation walls is not permitted.
(The floor must be supported by the edge beam or form a connected whole with it.)
- f. The ring beam must be made of reinforced concrete as shown in figure 2.9.2a & b in line with the following rules:



- I. At the eaves of the roof construction around the entire building periphery, to which the roof construction is anchored directly or via a wall plate anchored to the ring beam. Figure 2.9.2.c shows an example of detailing this connection. *(Other examples are presented in the Set of Guidelines. Pay attention to article 2.10.1.b!)*
- II. The ring beam must be connected to the foundation strip according to paragraph c of this article, at at least four locations to the sheet foundation by means of reinforced concrete columns or by means of reinforced concrete-filled hollow spaces in the masonry blocks. The concrete column shall be poured after the placement of the masonry to ensure a solid bond with the masonry, a disc effect.
- III. Roof anchored directly to the ring beam or via a wall plate anchored to the ring beam.
- IV. The ring beam, height $\geq 400 \text{ mm}^1$ (figure 2.9.2a: stirrups with angled hooks, figure 2.9.2.c) with a width equal to the width of the masonry wall must be provided with a continuous reinforcement as follows:
 - A. At door, window or other openings $\leq 1,20 \text{ m}^1$: B 500 A, reinforcement total $\geq 200 \text{ mm}^2$ ($4 \text{ } \varnothing 8 = 201 \text{ mm}^2$), stirrups $\geq \varnothing 6 - 250$.
 - B. At door, window or other openings $\leq 2,0 \text{ m}^1$: B 500 A, reinforcement total $\geq 300 \text{ mm}^2$ ($4 \text{ } \varnothing 10 = 314 \text{ mm}^2$), stirrups $\geq \varnothing 6 - 250$.
 - C. At door, window or other openings $> 2,0 \text{ m}$: The reinforcement must be determined by a structural engineer on the basis of structural calculation according to the requirements in article 1.1 paragraph 3 and 4.
- V. If due to the absence of tie rods, splash forces on the ring beam must be taken into account for the selected roof construction, the additional reinforcement in the ring beams must be determined by a structural engineer on the basis of structural calculations according to the requirements in article 1.1 paragraph 3 and 4.
- VI. In case of higher ring beams, height $> 400 \text{ mm}^1$, and ring beams subjected to an extra load (e.g. at the support point for the ridge batten and in the case of ring beams above wall openings $> 2,0 \text{ m}^1$), additional top, bottom and

longitudinal reinforcement must be inserted. This reinforcement must be determined by a structural engineer on the basis of calculations according to the requirements in article 1.1 paragraph 3 and 4.

- VII. Above non load-bearing inner walls, a concrete 'ring beam' with a height of $\geq 400 \text{ mm}^1$ with a width equal to the width of the masonry wall must be applied:
 - A. With a beam width of 100 mm^1 (4") the following applies:
 - B 500 A, reinforcement total $\geq 100 \text{ mm}^2$ ($2 \text{ } \varnothing 8 = 101 \text{ mm}^2$). Stirrups $\geq \varnothing 6 - 250$, the so-called 'S-hooks' (as in figure 2.9.2b).
 - B. With a beam width of $\geq 150 \text{ mm}^1$ (6") the following applies:
 - B 500 A, reinforcement total $\geq 200 \text{ mm}^2$ ($4 \text{ } \varnothing 8, 201 \text{ mm}^2$). Stirrups $\geq \varnothing 6 - 250$.
- VIII. Concrete strength class $\geq \text{C } 16/20$ (B20).
- IX. Concrete cover traditionally 25 mm^1 (permissible with plaster layers, thickness: $\geq 15 \text{ mm}^1$ outside and $\geq 10 \text{ mm}^1$ inside).
- X. The ring beam over the (non) load-bearing masonry walls must be produced as a continuous beam frame. The reinforcement in the intersections must be fully anchored or continuous. Avoid unnecessary dense concentrations of reinforcement at the intersections; preferably use hairpins to which the reinforcement is connected using an overlap, outside the connection.
- g. The walls are coated on the outside with a 15 mm^1 thick plaster layer and on the inside with a 10 mm^1 thick plaster layer.
- h. All non-loadbearing inner walls must be 6" (150 mm^1) walls. The walls must be produced in 'confined masonry': masonry enclosed by a ring beam and centre-to-centre separation $\leq 4,0 \text{ m}^1$ by concrete columns.
- i. Masonry stability walls must be load-bearing and produced in confined or reinforced masonry according to the following:
 - I. Starterbars $\varnothing 10 - 400$ ($\varnothing \frac{3}{8}" - 400$) rebar length $\geq 500 \text{ mm}^1$ must be added in the connection masonry-concrete floor/beam.
 - II. The minimum area of the stability walls, expressed as a percentage of the gross floor area of the building, in each direction, appears in table 2.9.2 under the condition that:
 - A. The building must have a rectangular shape, or be divided into rectangular shapes, with a ratio $w : l$ (width to length) $\leq 1 : 4$.
 - B. The storey height $\leq 3,0 \text{ m}^1$.
 - C. Masonry stability walls, including the windows contained in them, must have a length $\geq 1,20 \text{ m}^1$, in order to keep tensile strengths in the wall as low as possible or to prevent such stress.
 - D. Stability walls must be $\geq 150 \text{ mm}^1$ (6") thick.
 - E. The thickness of all outer walls and the load-bearing and non-loadbearing masonry inner walls is $\geq 150 \text{ mm}^1$, 6" blocks with a height $h \leq 3,0 \text{ m}^1$.
 - F. In the height of the building is more than $3,0 \text{ m}^1$, the stability walls must be designed and calculated by a structural engineer on the basis of calculations according to the requirements in article 1.1 paragraph 3 and 4.
 - G. Stability walls, must be c.c. 4.0 m^1 are laterally supported by transverse walls or piers with a length $\geq 0.6 \text{ m}^1$.
 - H. Also activate inner walls as stability walls, so that an even distribution of forces is achieved.

I. In the stability wall, at the position of the compression diagonal in the masonry, there must be no recess which intersects $\geq 50\%$ of the surface of the compression diagonal (width of the compression diagonal $2 \times 5t$. The remaining width of the compression diagonal is therefore $\geq 5t$. (t = thickness of the wall))

J. $\geq 75\%$ of the building weight must be supported by these stability walls. The greater the total weight on the wall, the greater the seismic load to be absorbed.

K. The stability walls must continue into the foundation, from top to bottom, so: including the inner stability walls.

L. At the position of the L, T and X connection, the 'legs' bricked into the wall in stretcher bond must have a length of twice the wall thickness $\geq 400 \text{ mm}^1$ to be considered a support connection in a stability wall.

M. The roof construction must be directly connected to the ring beams and together with the ring beams be produced as a disc-shaped construction.

TABEL 2.9.2

Type of masonry	Number of storeys/ building layers	Soil type unknown and Soil type rigid soil profile On steel foundation
Confined masonry	1	4,0 % *
Reinforced masonry	1	3,0 % *

* The minimum % area of the stability walls in each direction for buildings in BCO.

3. Timber walls

- a. Due to the numerous shapes and dimensions of buildings with a timber frame construction, it is almost impossible to combine all of these shapes in a single calculation. For building in a timber frame construction: see also the regulations from the manufacturer/supplier.
- b. The timber paneling, planks, beams, rafters, etc. must be treated for termite resistance.
- c. Guidelines and design rules*) for building in timber frame construction in earthquake areas and areas with high wind loads are:

*) *In part derived from: Hurricane Resistant Construction Manual "Are You Well Connected" (Government of Montserrat).*

- I. Buildings with a rectangular shape or divided into rectangular shapes with a ratio $w: l \leq 1:4$; the corners fitted with stability walls in two directions, supplemented with additional partition walls.
- II. L-shape: the L-shape is fragile due to the occurrence of torsion loads at the inner corner, because of increased risk of damage at that point.
- III. Storey height (eaves) $\leq 3,0 \text{ m}^1$. Higher buildings ($> 3,0 \text{ m}^1$) need to be designed and calculated by a structural engineer according to the requirements in article 1.1 paragraph 3 and 4.
- IV. The stability walls, including the windows and doors in the walls, must be load-bearing walls with a length of $\geq 1,2 \text{ m}^1$ in order to keep the tensile stresses as low as possible, or to prevent tensile stresses.

- V. Not exclusively stability walls in the facades. Also activate load-bearing inner walls.
- VI. Stability walls must be laterally supported centre-to-centre $\leq 4,0 \text{ m}^1$ by transverse walls or piers with a length of $\geq 0,6 \text{ m}^1$.
- VII. 75 % of the building weight must be supported by these stability walls.
- VIII. At the L, T and X-connections, the walls must be connected shear-proof.
- IX. The stability walls must run from the roof to the foundation and be anchored to the concrete foundation.
- X. For the ground floor, select a concrete floor, thickness $\geq 150 \text{ mm}^1$, to which the timber walls are anchored.
- XI. For intermediate floors (*in BCO only attic or mezzanine with restricted height*) and roof constructions made of light (timber) materials are allowed for BCO.

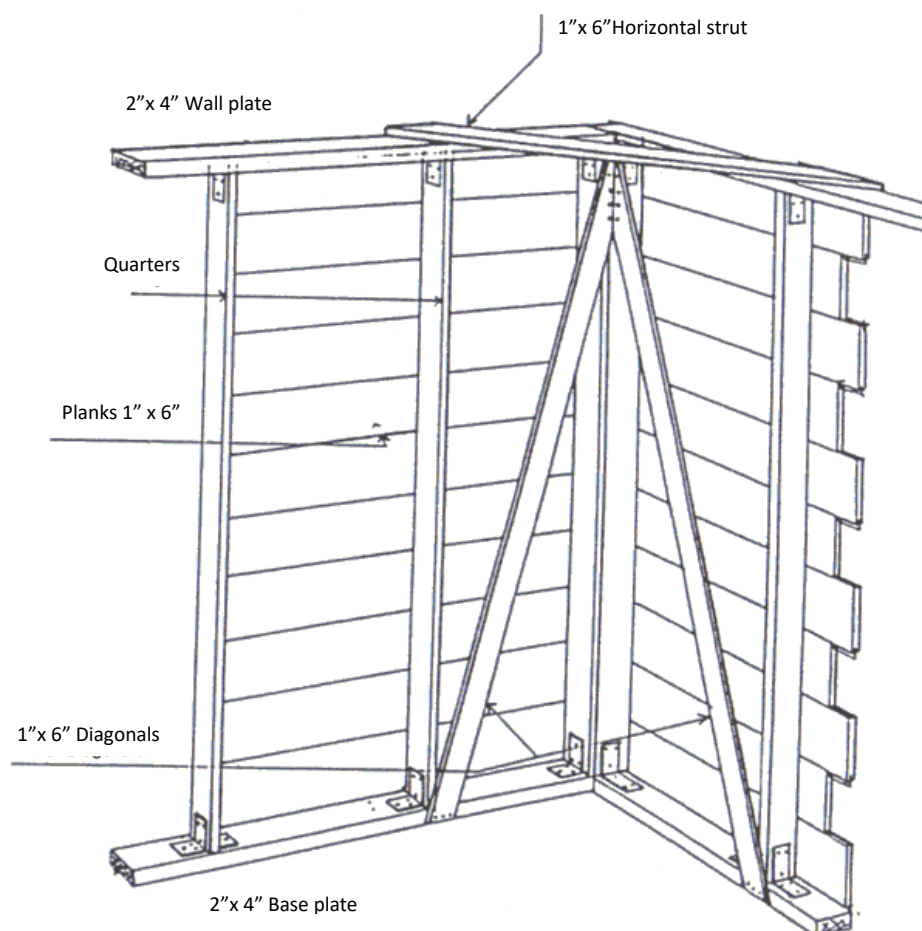


Fig.
2.9.3

Example of a timber frame wall with braces/diagonals

- XII. The floors and the roof construction should be produced as a disc-shaped construction. Wooden floors produced as a disc-shaped construction include for example multiplex or plywood sheets laid in a stretcher bond, or planks with tongue and groove joints (both nailed or screwed centre-to-centre 100 mm^1 to the load-bearing beams).
- XIII. Ensure anchoring of the floors and the roof to the (load-bearing) stability walls. The floors must be connected shear-proof to the stability walls and

together produced as a continuous 'disc-shaped construction', in both a vertical and horizontal direction.

- XIV. Avoid openings which cannot be sealed in the event of hurricane threat.
- XV. Avoid canopies that cannot be folded down and anchored to the façade.
- d. Timber walls produced as a disc-shaped construction include: The walls should be produced for example in multiplex or plywood sheets screwed centre-to-centre 100 mm¹ to the timber columns, beams and wall plates so that a single disc-shaped construction is formed. By way of alternative, above all in smaller (secondary) buildings, the following can be used: A wall cladding consisting for example of 1" x 6" planks with tongue and groove joint, screwed centre-to-centre 100 mm¹ to the timber uprights measuring ≥ 2" x 4" and with diagonals 1" x 6" (figure 2.9.3). At the bottom and top of the wall, a 'wall plate' ≥ 2" x 4".
- e. The connection between the wall plates and the uprights must be produced in Hurricane resistant fasteners (for example angle steel), screwed to the timber uprights and wall plates (figure 2.8.3).
 - I. In each corner and at all wall ends fit ≥ 1" x 6" braces.
 - II. The wall is anchored to the concrete ground floor using anchor bolts according to the regulations and calculations of the supplier.
- f. The posts that form the skeleton of the building must have a minimum size of 50 x 100 mm¹. The corner posts of this frame must be at least 100 x 100 mm¹. The distance between the posts should not exceed 1 m¹. Sufficient rules and braces must be applied between the posts. The posts must be anchored at the bottom in a base plate attached to the foundation and in a wall plate at the top.

Article 2.10 Roof-construction

1. General

- a. Because Sint Maarten is situated in the Caribbean, which is a region with seismic activity such as earthquakes, roofs made of reinforced concrete must be designed and calculated by a structural engineer. Therefore this type of roof is not allowed on BCO-buildings. If such a roof is preferred by the applicant of a building-permit he has to comply with the procedure regarding Building Class 1 (BC1) as prescribed in NBD article 1.7 etc.
- b. In order to prevent damage or blowing away of roofs caused by uplifting wind shears during a storm or hurricane, it is not allowed to make overhangs ≥ 300 mm¹ or to extend the roof of a building over the porch. If such a roof is preferred by the applicant of a building-permit he has to comply with the requirements in article 1.1, paragraph 3 and 4.

2. Rafter-built roof

- a. In the case of a rafter-built roof, the beams (rafters) run from the ridge to the roof base, (the main load bearing construction), whereby the horizontal and vertical forces from the roof construction are absorbed by the floor or the ring beam, both with or without a wall plate.
- b. Across the rafters battens are attached.
- c. The rafters are spaced at regular intervals, 0,61 or 0,813 m¹, whereby the forces are evenly distributed.
- d. The roof is or is not provided with roof boarding.
- e. With large spans, it may be necessary to use tension / pressure plates.

3. Girder roof

Due to the high wind load, a girder roof is not advisable. If such a roof is preferred by the applicant of a building-permit he has to submit calculations and drawings made by a structural engineer, as required in article 1.1, paragraph 3 and 4.

4. Strength class of wood

- a. (Yellow) Pitch Pine classes C18 or C24 according to an available inspection report or equivalent document.
- b. Because of splitting danger of nailed connections of Pitch Pine nailing connections are not allowed.
- c. Because of corroding Pitch Pine with iron, use only stainless steel connection material. (see also paragraph 9 of this article).

5. Timber protection

Treatment to make timber material termite-proof is necessary.

6. Anchoring and support structure for rafters

- a. The rafters must be installed and anchored directly onto the concrete ring beam (or sufficiently anchored to the ring beam via a wall plate).
- b. The wood of the roof trusses has to have a minimum diameter of 50 x 100 mm¹. The roof trusses must be provided with adequate struts and pull plates. All connections of the roof trusses must be carried out professionally.
 - I. If the hood is fitted without purlins, the distances of the trusses must not exceed 700 mm¹.
 - II. If the hood is fitted with purlins, the interval of the frames must ≤ 3 m¹.

7. Roof covering

- a. Roof covering must be 12 or 15 mm¹ thick multiplex, plywood, etc.
- b. Attachment of roof covering with 2" screws (so-called Hurricane screws), centre-to-centre ≤ 150 mm¹, in each rafter.
- c. The roof of a house must be a complete barrier against wind and rain.
- d. Roofing with tiles must not have a slope of less than 30 ° and roof coverings of corrugated sheets not less than 15 °. See however article 1.1. paragraph 1 and 2.3 paragraph 1 under a.

8. Corrugated sheets, support/attachment

- a. Corrugated roofing sheets in steel or aluminum (no fibro-cement!) and sandwich panels must be attached according to the guidelines of the manufacturer.
- b. Take note that the maintained wind load according to these guidelines is in accordance with the wind load mentioned in the National Building Decree, article 2.4.
- c. Support/attachment of timber battens with a nominal width of at 2" (38 mm¹) or more.
- d. Corrugated sheets should be attached with corrugated sheet bolts $\varnothing 6$ mm¹ or more, penetration length ≥ 25 mm¹, with a follower plate and a flexible ring in the shape of the roof sheet; No screw nails!
- d. Minimum number of attachments for the corrugated sheets to the supports is:
 - I. at all corners of the sheet;
 - II. at the position of the lateral sheet overlaps on all supports;

- III. along the roof edges parallel to the overhang, every corrugation;
 - IV otherwise every other corrugation;
 - e. Using corrugated sheets 26 gauge steel-thickness $\geq 0,70 \text{ mm}^1$ following the above, but: otherwise every third corrugation.
 - f. The holes in the metal sheets must be predrilled with 2 mm¹ wider holes in comparison to the bolts to prevent longitudinal cracking (= leaking and weakening) of the sheets.
 - g. Corrugated sheets must have a minimum overlap of one and a half wavelength on the side and 10 centimeters on the underside.
9. **Fasteners**
- a. Bolts/washers/nuts, screws, bar, stirrups, clamps, etc. must be resistant to damage in environmental class XS 1 (exposed to salts from the air but not coming into contact with seawater). Stainless steel DIN-A4, AISI 316, material no. 1.4401 (EN) materials are resistant to XS 1 climate.
 - b. In order to make safe connections between different parts of wood or metal and wood in walls, floors, roofs, etc. it is necessary to use screws instead of nails.
 - c. These screws need to be of appropriate quality to resist the conditions of weather (heat, heavy rain, hurricanes) and environment (salt, air pollution) and appropriate number, center-to-center-distance, diameter and length to transfer the forces (loads) from one part to another in a safe way.
 - d. This article is not only applicable on structural parts, but also on mounting of roof cover plates, gutters, rain pipes, air vents and pipes or air conditioning units, window and door frames, antennas, etc.
10. **Connectors (screws and threaded bolts, NO nails!)**
Attachment length must be $\geq 4 \times$ nominal diameter.
11. **Attachment of battens to the underlying rafters**
Battens, $\geq 38 \times 88 \text{ mm}^2$ (2" x 4"), must be attached using at least 2 x 6" (Hurricane) wood screws $\varnothing 5 \text{ mm}^1$ directly to the underlying rafters. Penetration length $\geq 4 d = 24 \text{ mm}^1$.
12. **Roof covering**
To guarantee the disc effect: Attachment of roof floors and roof covering with 2" screws (so-called Hurricane wood screws) centre-to-centre $\leq 150 \text{ mm}^1$ in each batten/beam.
13. **Rafters**
Dimensions of rafters $\geq 63 \times 184 \text{ mm}^2$ (3" x 8") length $\leq 4,25 \text{ m}^1$ (center ring beam – side ridge batten).
14. **Surge Limitation**
If the length of the rafters for gable roofs or hipped roofs between ring beam and ridge beam, as a result of larger spans, would be more than the 4.25 m¹ mentioned under 13 (or for pent roofs from low to high outer wall more than is available on Sint Maarten: maximum 6,10 m¹), the roof structure shall be designed and calculated by a structural engineer, as required by Article 1.1, paragraphs 3 and 4.

Article 2.11 Timber floors

1. The floors of mezzanines and attics must be produced as a disc-shaped construction (in the same way as the wall cladding, mentioned in article 2.9).
2. Ensure anchoring of the floors and the roof to the (load-bearing) stability walls.
3. The floors must be connected 'shear-proof' to the stability walls and together produced as a continuous 'disc-shaped construction', both in a vertical and horizontal direction.
4. For the dimensions of the intermediate floors and attic floors + anchoring, see regulations and calculations from the supplier.
5. Spans and beam dimensions:
 - a. With a span of 2 m¹, the beam dimensions approximately: 50 x 150 mm².
 - b. With a span of 3 m¹, the beam dimensions approximately: 60 x 160 mm².
 - c. With a span of 4 m¹, the beam dimensions approximately: 80 x 180 mm².
 - d. With a span of 5 m¹, the beam dimensions approximately: 80 x 230 mm².
 - e. With a span of 6 m¹, the beam dimensions approximately: 80 x 280 mm².
6. The centre-to-centre distance of the floor joists may not exceed 650 mm¹.
7. The wood of the floor as well as of the wall coverings must be made of plowed good lumber of at least 23 mm¹ thick.

Section 3 Fire safety

Article 3.1 Kitchen

1. In the case of buildings located less than 25 m¹ from other buildings, the kitchen floor and the walls of the kitchen must be made of non-flammable material.
2. If there is no separate kitchen in a building that is entirely or partly intended for the home, the floor and the walls of one of the rooms must be made of non-flammable material.

Section 4 Sewerage etc.

Article 4.1 Disposal

1. The owner of a building is obliged to ensure that the surrounding property is properly drained and the household water is removed to the appropriate drainage pipes.
2. If it is not possible to drain the property properly, the household water must be discharged to a sump with a capacity of at least 1 m³ for each dwelling connected to it and closed from above and provided with a stench-pipe.
3. The gutters and sewers on the grounds must be kept in proper condition, so that no water or dirt remains in them. If gutters continue over a neighbouring property, iron bars should be placed on the yard boundary at no greater distance than 0.2 meters and properly maintained.
4. The distance between the outer walls of a house and the outside walls of a cesspool or sump must be at least 1 m¹. The distance between a well or a cistern built in the ground and a bear or sump may not be less than 75 and 50 m¹, respectively. In certain cases, the Minister can grant exemption from the latter regulation.

Article 4.2 Toilet unit

1. Each toilet unit has to be closed by walls of stone or well plowed lumber, by a dense ceiling and a tight closing door of the surrounding space. The toilet units must have a direct connection with the open air through a movable window or through an air duct of at least 0.2 m² of surface and be inaccessible to flies.
2. The toilet units, who discharge into a sewer, must be provided with sufficient water flushing.
3. The toilet units, who cannot discharge into a sewer, have to discharge into a closed container with a content of at least 3 m³ for each of the abovementioned dwellings, unless indicated differently by the Minister in an Ministerial regulation as mentioned in the Building Decree.

Section 5 Ground floor level, measurements of rooms, windows and doors

Article 5.1 Ground floor level

The minimum height of the floor of the house must be at least 0.20 m¹ above the crest of the road according to instructions given by the Minister.

Article 5.2 Measurements of rooms in a house

1. The main entrance of a house must be at least 0.85 m¹ wide, measured over the day and at least 2 m¹ high over this width.
2. If a corridor or portal is made in a house, it must have at least a width of 0.85 m¹, a height of 2 m¹ and a surface of 1.25 m², after deduction of all panelling.
3. One of the spaces intended for living room must have a floor area of at least 12 m².
4. One of the rooms, intended for sleeping accommodation, of at least 7 m².
5. A kitchen of at least 4 m².
6. Each of the other rooms of at least 5 m².
7. If there is no separate bedroom in a building that is entirely or partly intended for the home, the living area must have a floor area of at least 21 m².
8. The floors of the rooms must be above the level referred in article 5.1.
9. The ratio between the largest and smallest dimension of a room may not exceed 5 to 3.
10. The surface of the rooms and of the kitchen is measured between the timbering at a height of 1 m¹ above the floor.
11. The smallest/lowest wall-height of the rooms must be at least 2.60m.

Article 5.3 Daylight and fresh air

1. Every room in a house must receive daylight and air directly from outside through one or more movable windows.
2. The joint window surface, through which the daylight and the outside air must be able to enter unhindered, must not be less than 1/15 of the floor area.
3. When these windows receive their light from corridors between buildings of less than 2 m¹ wide, or from inner courtyards less than 3 m¹ wide, measured perpendicular to the

plane of the window, the surface of these windows is only taken into account for $\frac{3}{4}$ of this surface.

4. As the window area in the above sentence, in the case of non-movable windows, is the surface, measured in the cabinets of the blinds, and in the case of movable windows, is the surface, measured in the day of the window frame.

Article 5.4 Safety of windows and doors

1. The mounting of separate prefab or self-made frames for windows or doors in outside walls must be done by application of screws in appropriate quality, numbers, centre-to-centre-distances, diameter and length according to the instructions of the manufacturer/supplier. (See also article 2.10 paragraph 9.)
2. Application of good locks and hinges, dividing big glass surfaces in smaller parts through strong middle profiles and glass with extra thickness is necessary to prevent unintended opening of doors and windows or breaking of glass in case of heavy storm or hurricane.
3. To provide adequate ventilation in case a longer lasting hurricane, when doors and windows need to be kept closed, air vents or pipes in all outside walls and on the roof are necessary.
4. To protect doors en windows in case of heavy storm or hurricane it is helpful to keep available wooden plates in adequate dimensions to cover these wall-openings when necessary.

Article 5.5 Dimensions of stairs

The provisions in paragraphs 2.3 and 2.5 of the National Decree, to which this Practical Guideline/Code of Practice belongs, apply to the width, clear height, railing height, tread and rise of stairs inside and outside a structure in Building Class 0.

----- The End -----