

HOME STRENGTHENING GUIDE

HOW TO ECONOMICALLY STRENGTHEN YOUR HOUSE AGAINST EARTHQUAKES AND HURRICANES



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1.0 CONTRACT

This Home Strengthening Guide allows homeowners to economically strengthen their masonry or timber houses. You, the home owner, can print out these pages and give them to 3 building contractors and ask them for their prices to complete the work. You then need a contract. I have provided an example of a contract below.

Building Strengthening Contract

I _____ [Contractor] of _____
[Contractor's address] agree to strengthen the house owned by _____
[Owner] located at _____ [House address]
in accordance with the methods provided in Walbrent College's Home Strengthening Guide,
for a total lump sum cost of _____ Barbados
dollars and within _____ calendar days (excluding weekends and national holidays).

The break down follows.

Item 1 _____	Item 2 _____
Item 3 _____	Item 4 _____
Item 5 _____	Item 6 _____
Item 7 _____	Item 8 _____
Item 9 _____	Item 10 _____
Item 11 _____	Item 12 _____
Item 13 _____	Item 14 _____

Any variations, disputes, or any other contractual matter will be addressed in accordance with the provisions of the Barbados Association of Quantity Surveyors' Standard Form of House Building Contract.

Signed _____ [Contractor] _____ [Owner]
Date _____

2.0 ROOF

Figure 2.1 shows how the roof should be connected in a masonry house.

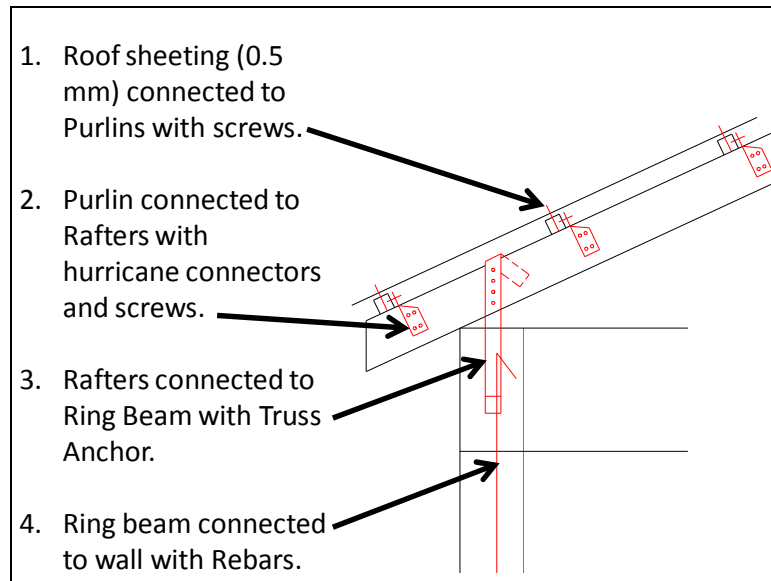


Figure 2.1 – Typical roof connections

Item 1 - The metal sheeting should be connected to the purlins with screws spaced 150 mm (6") apart. Your screws are probably spaced 300 mm (1 ft) apart. If they are, then just purchase the same amount of screws that are already on your roof and insert one screw between them.

Item 2 - Install two hurricane connectors (preferably stainless steel) at each rafter to ridge beam connection (including the jack rafter connections) as shown in Figure 2.2. Use screws not nails.

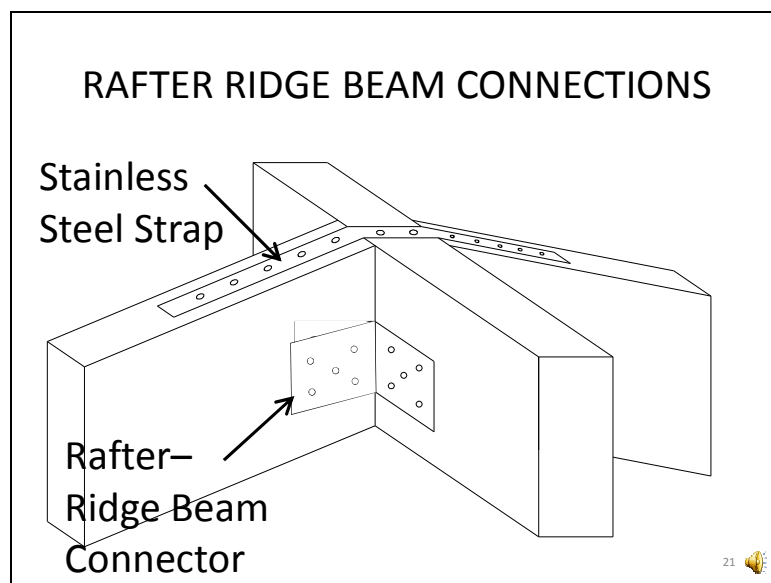


Figure 2.2 – Rafter to ridge beam connector

Item 3 - If you have installed a stainless steel multi-purpose strap over the ridge and rafter/ridge connectors as shown in Figure 2.2, then that should be adequate. Otherwise, install a minimum 2"x4" treated pine collar tie with hurricane connectors at each rafter to ridge connection as shown in Figure 2.3. Do not use nails on an existing roof. The hammering may cause leaks and weaken other joints. Always use screws. You may need to pre-drill holes on hard woods.

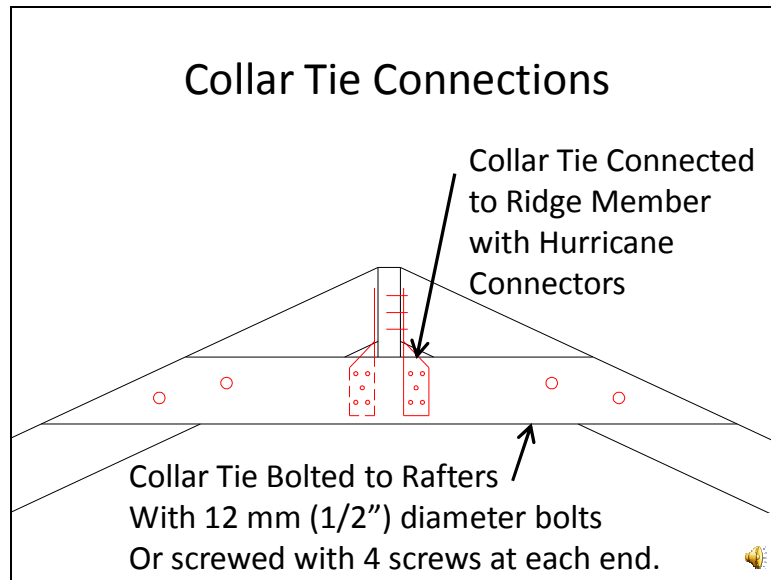


Figure 2.3 – Collar tie

Item 4 - If you have not used truss anchors to connect the roof to the ring beam as shown in Figure 2.4, then install a rafter to purlin connector as shown in Figure 2.5. Connect the rafters to the wall using concrete screws and some structural epoxy as follows. Mark the holes, drill the holes, blow out the dust with a straw or use a bicycle pump, insert some epoxy, and install the screws.

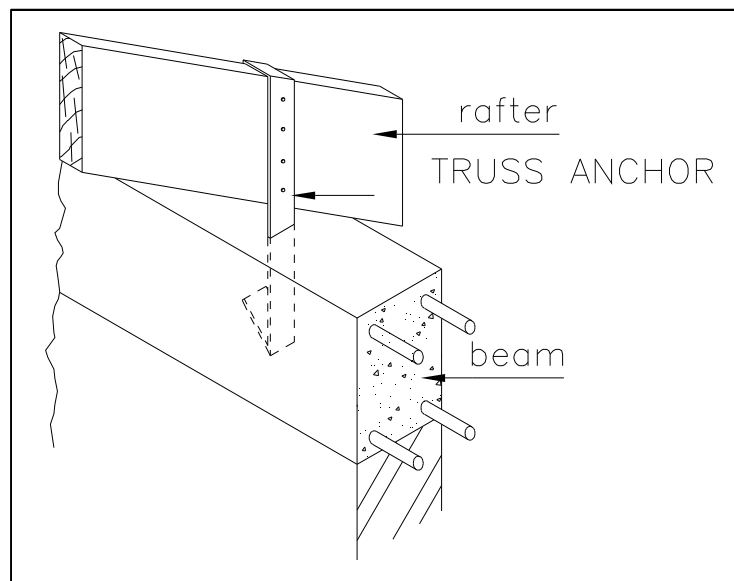


Figure 2.4 – Rafter to concrete beam truss anchor connection

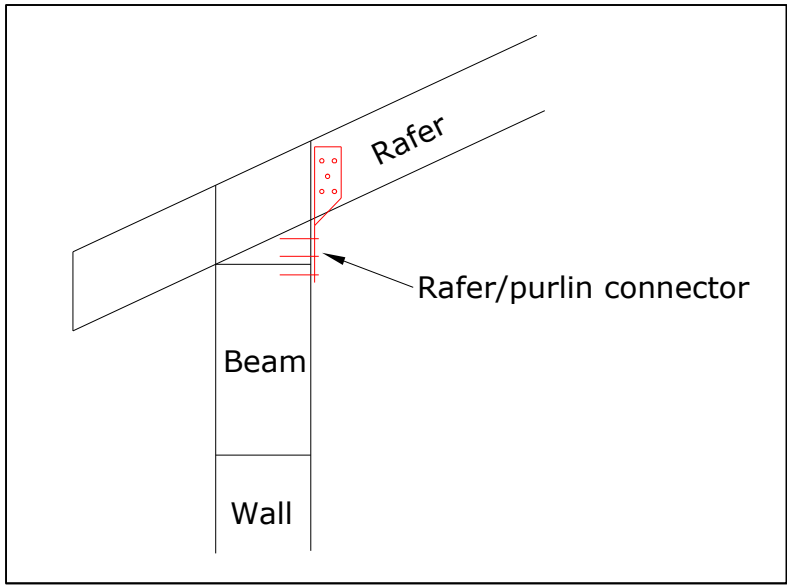


Figure 2.5 – Rafer/beam connection

3.0 MASONRY (Concrete block) WALLS

To prevent the masonry walls from collapsing, there should be 12 mm diameter reinforcing bars spaced and grouted 600 mm (24") in the external walls as shown in Figure 3.1

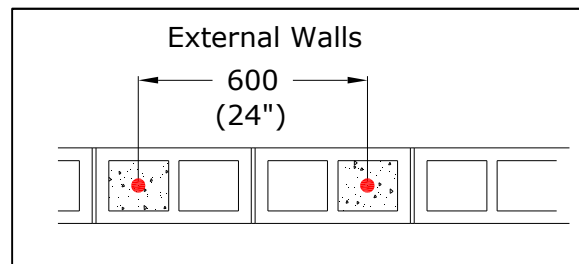


Figure 3.1 – Vertically reinforced masonry wall

Also, the corners should have three tied bars as shown in Figure 3.2.

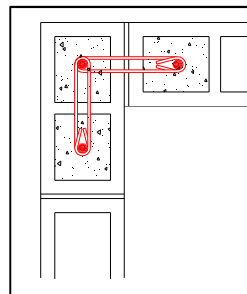


Figure 3.2 – Corner reinforcement

Item 5 - Your house likely has only one vertical rebar at the corner and spaced 1.2 m (4 ft) apart and not properly grouted. Draw a mark (with a pencil or chalk) where the bars should be on the external face of the walls as shown in Figure 3.3. A rebar should also be at all window and door wall ends.

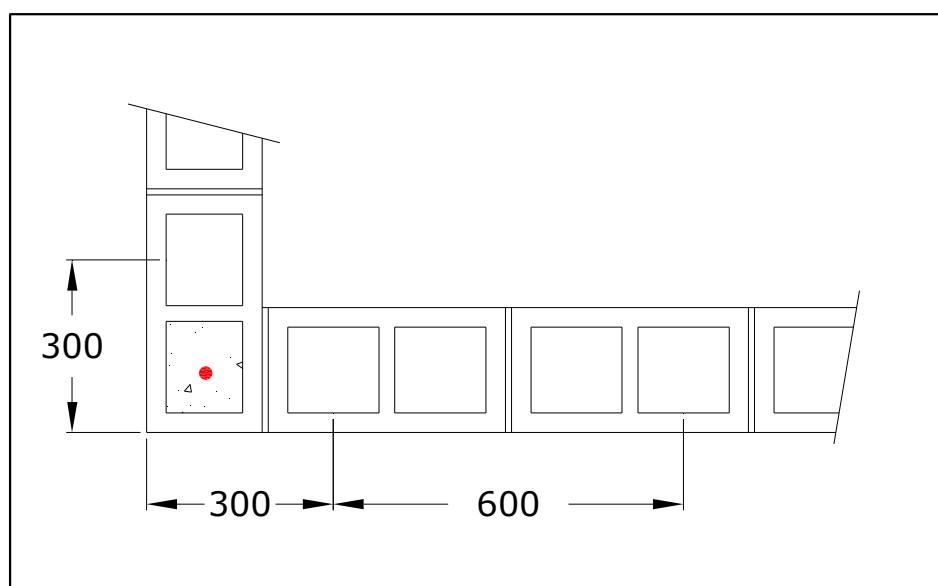


Figure 3.3 – Locations of vertical rebar.

Use a diamond saw and cut a 100 mm (4") wide slot in the block wall as shown in Figure 3.4. Clean out the debris, and drill a 50 mm (2") deep hole, 16 mm in diameter, in the bottom of the ring beam. Ideally a similar hole should be drilled through the floor slab; however, you risk puncturing the electrical and plumbing pipes in the concrete floor. Therefore, carefully roughen the surface of the floor to a maximum depth of 12 mm (1/2") – be very careful and do not go very deep because water and electrical pipes may be just below the surface.

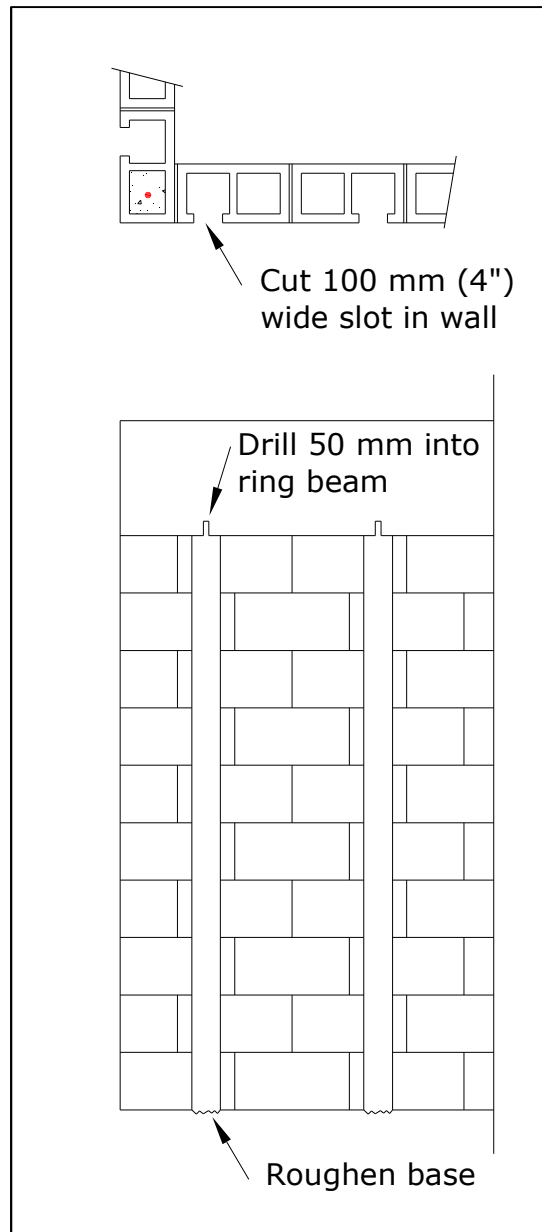


Figure 3.4 – Preparing the wall

Clean the roughened surfaces and the drilled holes and install the reinforcing bars through the top holes with epoxy. Block 1/3 rd of the wall and pour grout (1 cement : 3 sand : 6 stone (12 mm max diameter) stone). Use another rebar or a thin concrete vibrator to compact the grout. Pour the other thirds, and then fill the top hole with a stiffer concrete mixture. See Figure 3.5.

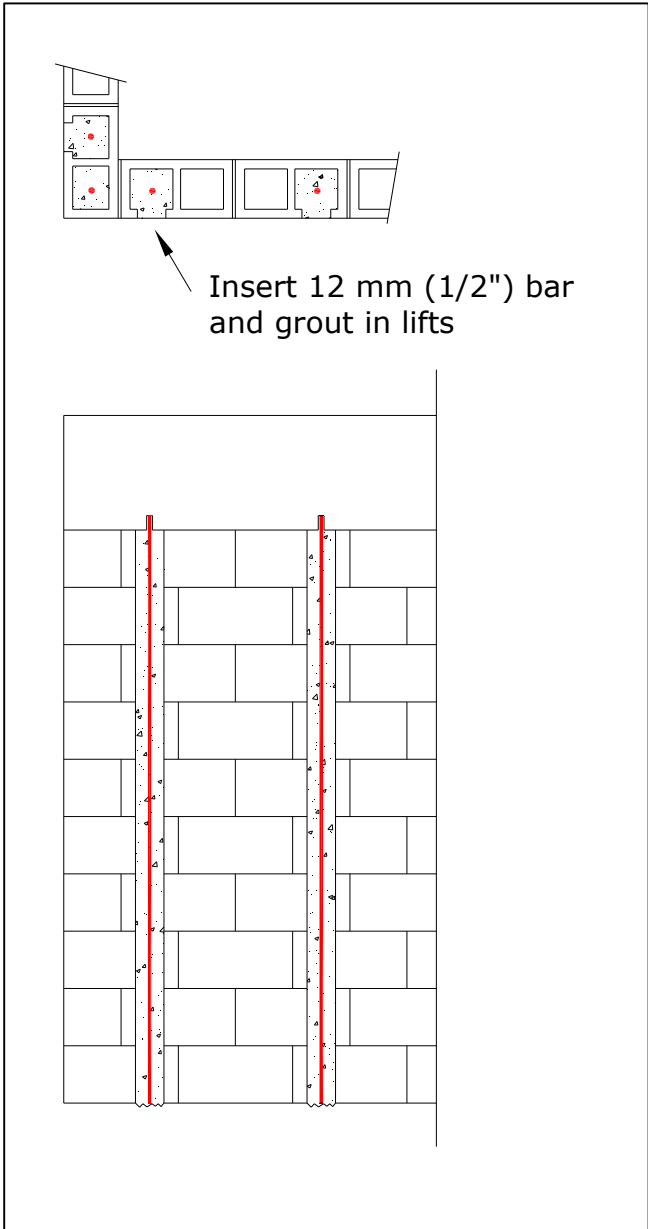


Figure 3.5 – Reinforced wall

4.0 TIMBER WALLS

Item 6 - Connect the rafters to the top plate using a hurricane connector shown in Figure 4.1.

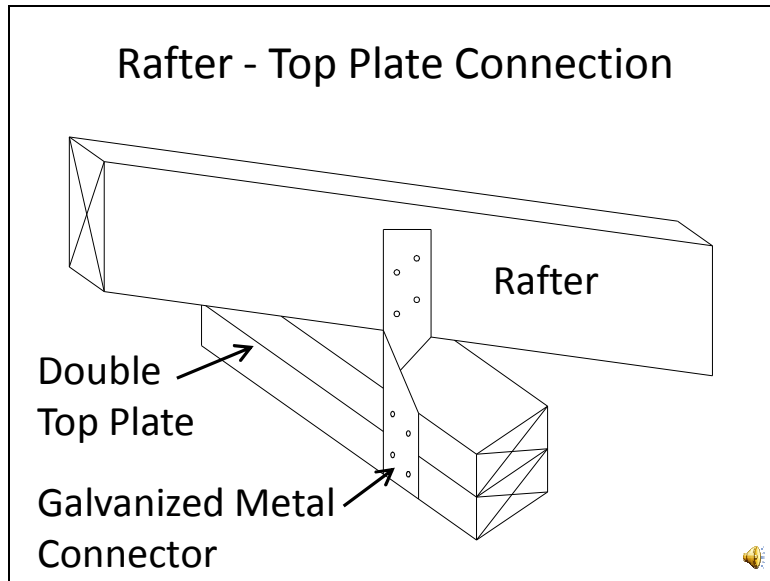


Figure 4.1 – Rafter top plate connection

Item 7 - Connect the top plate to each stud with a hurricane connector as shown in Figure 4.2.

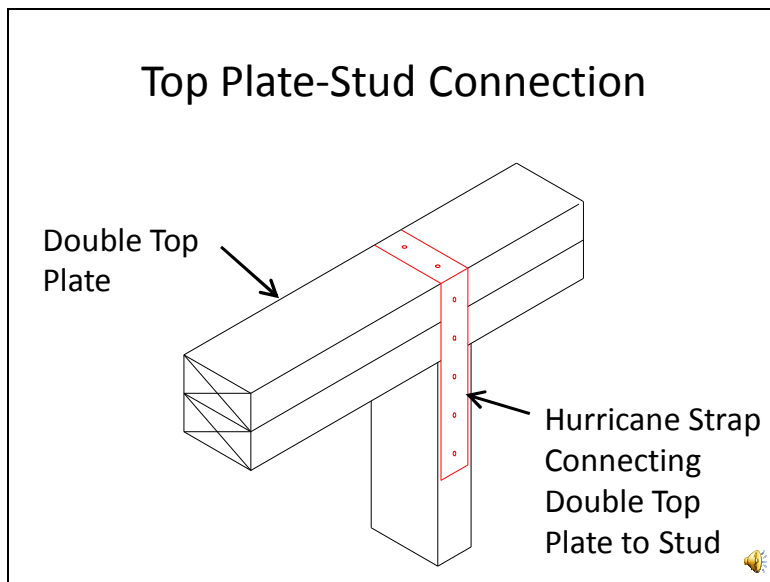


Figure 4.2 – Stud/top plate connection

Item 8 - Connect the stud to the base plate using a hurricane connector as shown in Figure 4.3.

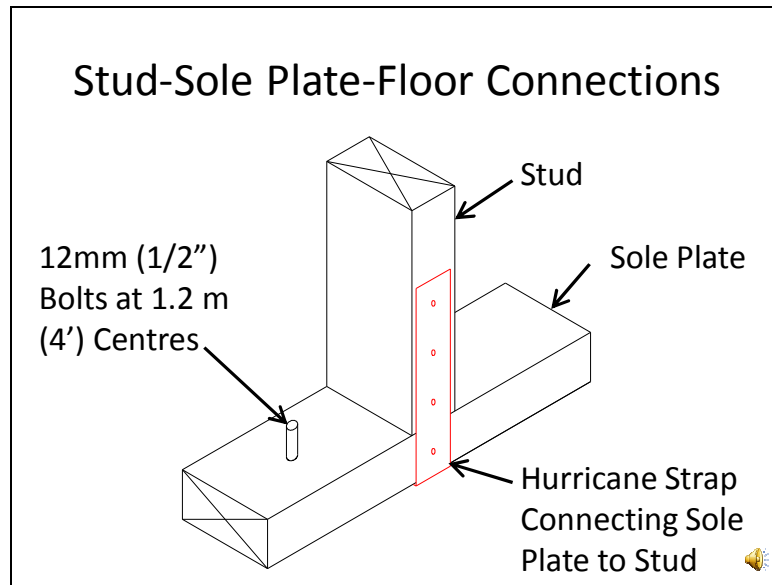


Figure 4.3 – Stud/sole plate connection

Item 9 - Connect the base plate to the concrete floor by forcing liquid nails or epoxy between the timber/concrete floor joint at 300 mm (1 ft) centres. Ideally a threaded rod should be installed at 1.2 m (4 ft) centres, but you risk puncturing the electrical and plumbing pipes in the concrete floor.

Item 10 - If a timber floor is used, then connect the joists to the sole plates and bearers with rafter/purlin hurricane connectors, and connect any bearers to the foundation piers with stainless steel truss anchors. See Figure 4.4.

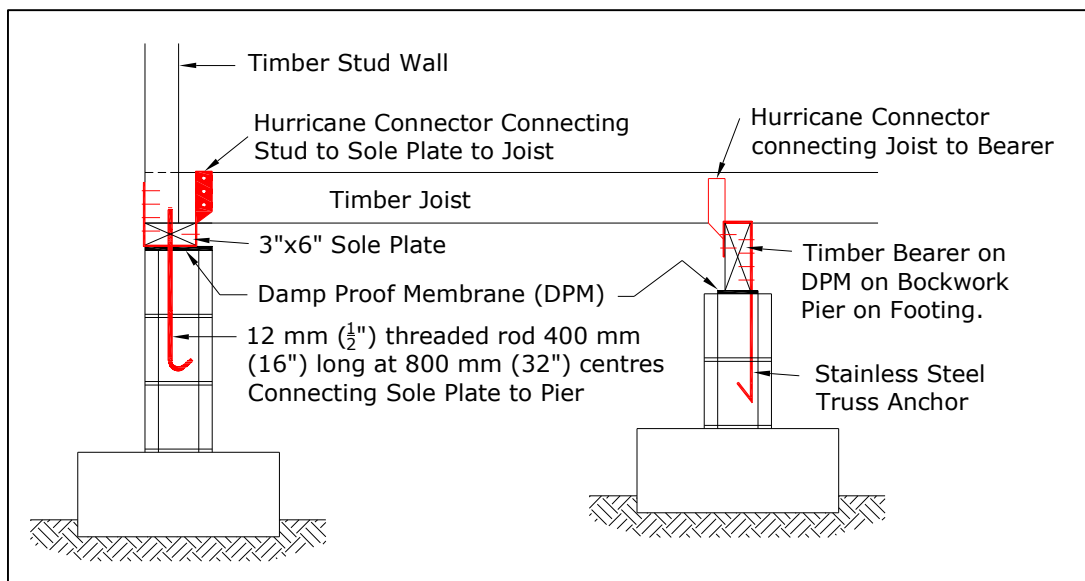


Figure 4.4 – Timber floor connections

Item 11 - Brace all corners with 2"x4" treated pine as shown in Figure 4.5.

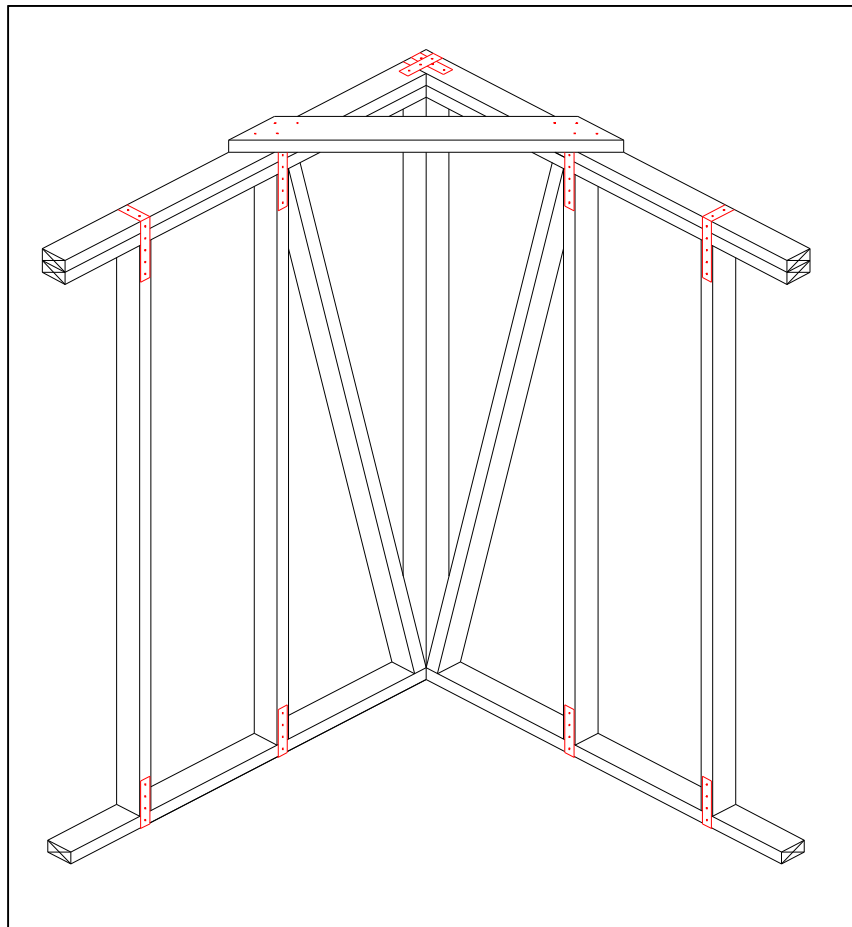


Figure 4.5 – Braced corner connections

Item 12 - Install additional studs to strengthen window and door openings. Also, install any missing horizontal noggins at mid height as shown in Figure 4.6.

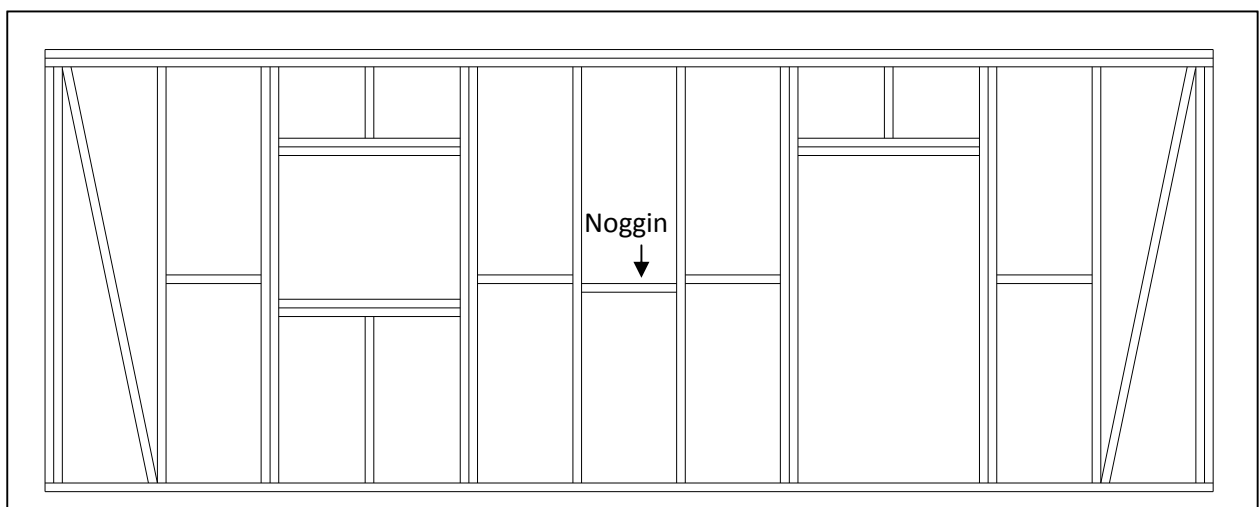


Figure 4.6 – Timber wall strengthening

5.0 WINDOWS AND DOORS

Item 13 - Install door and window frames to the wall using screws at the corners and at 600 mm (2 ft) centres as shown in Figure 5.1.

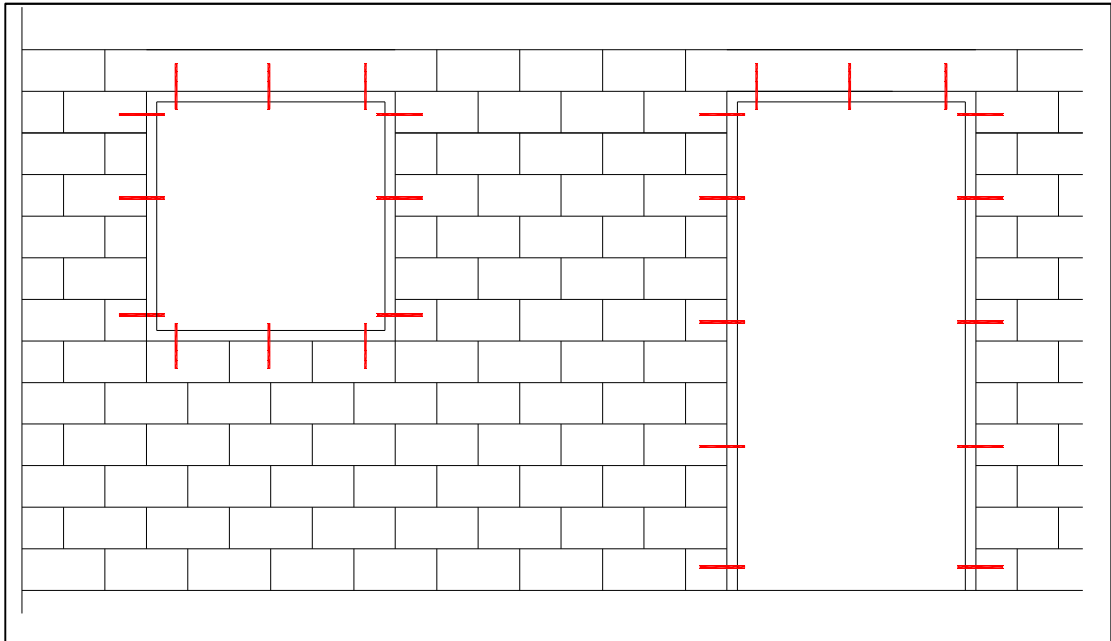


Figure 5.1 – Window and door frame connections

Item 14 - Install bolts at the top and bottom of doors so that they are connected at all four corners as shown in Figure 5.2. Make sure that the hinges carry the full amount of screws and that they are tightened.

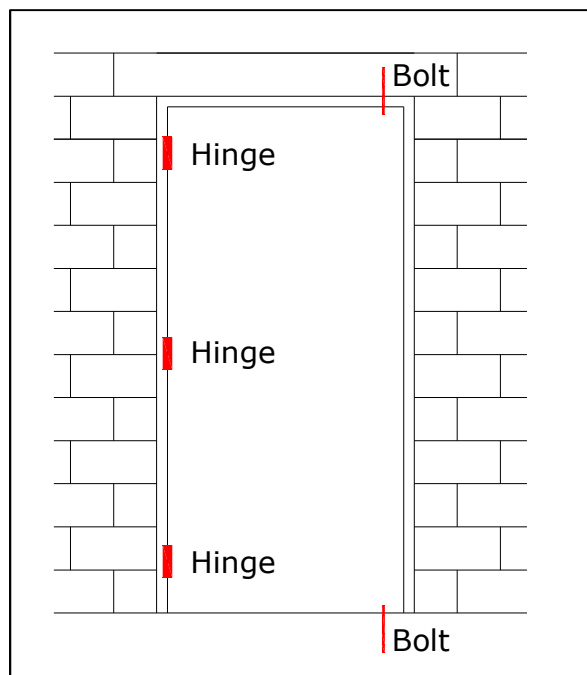


Figure 5.2 – Door connections

End.