CONSTRUCTION INFORMATION

for a

STRONGER HOME

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1. All concrete to be a minimum of 3000 psi compressive strength after 28 days.

2. Reinforcing steel in concrete in contact with the ground must have a minimum of 3" of concrete cover.

3. All reinforcing steel to be deformed bars with a yield strength of 36,000 psi and must conform to ASTM A615, A616, A617, A706, A767, and A775. Welded wire fabric must conform to ASTM A185.

4. All framing lumber and plywood sheathing to be pressure treated in accordance with the American Wood Preservers Association. Lumber treated with waterborne preservatives must be handled in accordance with the manufacturer's safety data sheets (MSDS).

5. All framing anchors and fasteners are to be properly galvanized and properly sized.

6. All framing anchors and connectors must be fastened as specified by the manufacturer.

8. Masonry mortar to be only Type M proportioned in accordance with Section 607, 1995 CABO Code. Masonry construction shall be designed and constructed in accordance with ACI 530/ASCE 5/TMS 402, or all applicable provisions of Section 604, CABO, 1995.

9. All concrete footings shall be placed on undisturbed soil, natural bedrock, or engineered fill.

10. All construction must comply with the building code. You are required to obtain the necessary building permits from the Department of Planning and Natural Resources.
# Tables for Sizing Hurricane Straps Tying Rafters to Wood Framed Walls - 3x Rafter Members

## Wind Uplift Forces on Rafters (in pounds)

### Table for Rafters Spaced at 24 Inches on Centers

<table>
<thead>
<tr>
<th>Wind Uplift Pressure on Roof (psf)</th>
<th>Total Building Width (Including Overhangs, in feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24</td>
</tr>
<tr>
<td>55 (one story)</td>
<td>1032</td>
</tr>
<tr>
<td>59 (two story)</td>
<td>1107</td>
</tr>
<tr>
<td>64 (three story)</td>
<td>1200</td>
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</tbody>
</table>

### Table for Rafters Spaced at 32 Inches on Centers

<table>
<thead>
<tr>
<th>Wind Uplift Pressure on Roof (psf)</th>
<th>Total Building Width (Including Overhangs, in feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24</td>
</tr>
<tr>
<td>55 (one story)</td>
<td>1376</td>
</tr>
<tr>
<td>59 (two story)</td>
<td>1476</td>
</tr>
<tr>
<td>64 (three story)</td>
<td>1600</td>
</tr>
</tbody>
</table>

## Recommended Connector - Rafter to Wall Double Top Plate

### Table for Rafters Spaced at 24 Inches on Centers

<table>
<thead>
<tr>
<th>Wind Uplift Pressure on Roof (psf)</th>
<th>Total Building Width (Including Overhangs, in feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24</td>
</tr>
<tr>
<td>55 (one story)</td>
<td>2-MTS12Z</td>
</tr>
<tr>
<td>59 (two story)</td>
<td>2-MTS12Z</td>
</tr>
<tr>
<td>64 (three story)</td>
<td>2-MTS12Z</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Wind Uplift Pressure on Roof (psf)</th>
<th>Total Building Width (Including Overhangs, in feet)</th>
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<tbody>
<tr>
<td></td>
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<td>55 (one story)</td>
<td>2-MTS12Z</td>
</tr>
<tr>
<td>59 (two story)</td>
<td>2-MTS12Z</td>
</tr>
<tr>
<td>64 (three story)</td>
<td>2-MTS12Z</td>
</tr>
</tbody>
</table>

**Note:**
FEMA does not specifically endorse Simpson Strong-Tie connectors. Connectors produced by other manufacturers that equal the specifications of the noted connectors may be substituted.
IMPORTANT CONSTRUCTION CONSIDERATIONS

1. Hip roofs are aerodynamically more resistant to uplift and generally perform better in strong winds than gable roofs.

2. Tie the house down from top to bottom with hurricane/seismic resistant connectors and or the appropriate masonry/concrete reinforcing.

3. Soffit and gable end overhangs should be eliminated or reduced to two feet or less. Gable ends are to be balloon framed, or braced.

4. Wood walls must be permanently connected and properly braced. Masonry walls must be vertically and horizontally reinforced.

5. Porch roofs should be independently framed and not an extension of the main roof system.

6. Window and door openings should be protected from wind loads and debris impact, using permanent shutters or temporary plywood or metal panels.

7. All construction must comply with the building code. You are required to obtain the necessary building permits from the Department of Planning and Natural Resources.
CONSTRUCTION GUIDE FOR
HURRICANE AND SEISMIC RESISTANT
ONE AND TWO FAMILY DWELLING CONSTRUCTION
IN THE U.S. VIRGIN ISLANDS

The following construction drawings are for general use. They are not specific house designs.

The suggested specifications are related to the structural qualities of the noted materials. The details predominantly show a wood roof structure with sheet metal roofing supported by wooden or masonry walls; & wood or concrete floor, and continuous foundations and individual footings for a single family one story residence.


These specifications are applicable to common Virgin Island residential construction methods. If your home is significantly different consult a Registered Professional Structural Engineer or Licensed Architect.

All construction must comply with the building code. You are required to obtain the necessary building permits from the Department of Planning and Natural Resources.

Prior to construction contact U. S. V. I. Department of Planning and Natural Resources, Division of Permits for building requirements in the Virgin Islands. This information has been developed solely as guidance and is believed to meet the U. S. V. I. building code. All drawings must be separately approved by DPNR, Division of Permits upon submission of a building permit application.
ROOF CONNECTION TO MASONRY WALLS
REINFORCED MASONRY WALL:
FILL CELLS WITH GROUT
C REBAR LOCATION.

REINFORCED CONC. FL.

FOOTING REINFORCING BARS

WIDTH DEPENDENT ON SOIL & LOADING CONDITIONS

CONTINUOUS STRIP FOOTING

NOTES:
1. FOOTINGS TO BE PLACED ON UNDISTURBED SOIL OR ENGINEERED FILL
2. SEE TABLE 404.1.1D 1995 CABO FOR ADDITIONAL WALL REINFORCING INFO.
3. EXTERIOR MASONRY WALLS MUST BE LATERALLY BRACED EVERY 12'
   FOR SEISMIC ZONE 4. SEE TABLE 404.1.1D CABO.
Plain common sense measures that could help prevent losses

A HOUSE IS ONLY AS STRONG AS ITS WEAKEST CONNECTION
SIMPLE BUILDING TECHNIQUES AND MATERIALS THAT CAN STRENGTHEN
YOUR WOOD FRAME BUILDING

SOLIDIFY THE MIDDLE
TIE ALL PIECES TOGETHER USING NAILS AND STRUCTURAL CONNECTORS.

START FROM THE GROUND UP.
ANCHOR THE WALL STUDS AND BOTTOM PLATE TO THE FOUNDATION
WITH GALVANIZED ANCHOR BOLTS AND WALL SHEATHING.
Table 3: Connectors

FEMA does not specifically endorse the connectors of any manufacturer. Connectors that equal the specifications of referenced connectors may be substituted. Cross references courtesy of connector manufacturers. See CABO National Evaluator Report to additional cross referencing information. Specific loads require specific connectors. No attempt has been made to represent the entire connector line of any manufacturer or to specify all connectors that meet code in all applications. See manufacturers specifications and the tables in the DPNR and FEMA Construction Information For A Stronger Home for more comprehensive information.

<table>
<thead>
<tr>
<th>Application</th>
<th>Connector Manufacturer</th>
<th>Simpson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Band Joist to Sill Plate</td>
<td>Hughes MPA1</td>
<td>A35F, LTP4</td>
</tr>
<tr>
<td></td>
<td>Kantsg MPA1F</td>
<td></td>
</tr>
<tr>
<td>Trimmer/Stud/Plate/Foundation</td>
<td>PAHD42 RFS25</td>
<td>PAHD*, FSA</td>
</tr>
<tr>
<td></td>
<td>PAHD42, LTS*</td>
<td>LTT*, MTT*, HTT*</td>
</tr>
<tr>
<td>Stud to Band Joist</td>
<td>HC20, RT8112TW, HLSTA18, HST22, RT18112TW, HMSTA24</td>
<td>H6, MSTA24, MTS18</td>
</tr>
<tr>
<td></td>
<td>TWIST22 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MSTA24 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSTA18 Θ, S1221Θ</td>
<td></td>
</tr>
<tr>
<td>Studs to Sill and Top Plates,</td>
<td>PT1, PT2, TP4X, MPA1</td>
<td>SPT22, SPT24,</td>
</tr>
<tr>
<td>Band Joist</td>
<td>2-HCDPL</td>
<td>S88, MPA1,</td>
</tr>
<tr>
<td></td>
<td>2-HCLH/RH-20</td>
<td>2-RT7.2-RT3Θ</td>
</tr>
<tr>
<td></td>
<td>RT18112TW</td>
<td>SP1, SP2, SP4, A35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H6, MTS12</td>
</tr>
<tr>
<td>Stud to Band Joist to Stud</td>
<td>HCS16, RT18112TW</td>
<td>CS16, MTS*,</td>
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<td></td>
<td></td>
<td>MSTA36</td>
</tr>
<tr>
<td></td>
<td>MSTA36 1</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>LSTA18 Θ, S1221Θ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSTA18</td>
<td></td>
</tr>
<tr>
<td>Header/Trimmer/Stud</td>
<td>RT18112TW HST22</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood Framed Wall to Rafter/Truss</td>
<td>RT18112TW JHA418</td>
<td>LTS18, MTS18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H7, H10, THA218, THAI322</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masonry Wall to Rafter/Truss</td>
<td>TA20R, HC10 HTA-Series RT18112TW JHA418</td>
<td>ETA20, H10 HETA 20 LTS18, MTS18 THA218, THAI322, PA23, MTT28B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWIST18 MSH218, PA23</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rafter to Ridge to Rafter</td>
<td>HST22 w/MPA1 HMSTA24</td>
<td>MSTA24, LS50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LSU*, LS5U*</td>
</tr>
<tr>
<td></td>
<td>S1221ΘwMPA1, MSTA24Θ, MP5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MSTA24, LS50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSU*, LS5U*</td>
<td></td>
</tr>
<tr>
<td>Rafter to Hip or Gable Rafter</td>
<td>HST22 w/MPA1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S1221</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MSTA24Θ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TMU26Θ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MSTA24, LS50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSU*, LS5U*</td>
<td></td>
</tr>
</tbody>
</table>

*indicates a series of connectors

1 Design variation, application is comparable
2 Consult factory for design specifications
ROOF FRAMING & COVERING

LAP GALV ROOF 6" (MIN) OR 2 CORRUGATIONS.

STRUCTURAL ROOF SHEATHING OR TEXTURED PLYWOOD

2X4" PT. PURLINS, DOUBLE PURLINS AT RIDGE AND EDGE OF EAVES.

RAFTER

NOTE:
1. SHEATHING TO RAFTER, #7 SCREWS, 2 3/4" C.C. AC CURBING EDGES, 12" OC ON INTERIOR OF PLYWOOD SHEETS, #7 SCREWS, 2" WHERE SHEATHING IS 3/4" OR LESS.
2. PURLINS TO RAFTERS, #10 SCREWS 4" LONG, 12 PEL PURLIN OVER EACH RAFTER, OPTIONALLY, WHERE SHEATHING IS 3/4" OR LESS #14 SCREWS, 2 1/4" MAY BE USED.
3. ROOFING TO PURLINS, #14 SCREWS, 2" LONG @ 4" OC. ALL RIDGES, GABLES, AND HIP - 8" OC ELSEWHERE.

4. LAY FELT PARALLEL TO THE EAVES, WITH A TWO INCH END LAP NAILED SUITABLY TO HOLD IT IN PLACE. LAP 2" HORIZONTAL AND 6" VERTICAL, MINIMUM.
Table 4: Structural Wood Panels

<table>
<thead>
<tr>
<th>Rafter spacing in inches</th>
<th>Acceptable Structurally Rated Sheathing</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>5/8&quot; T-1-11 or 3/8&quot; CDX (Minimum)</td>
</tr>
<tr>
<td>16</td>
<td>5/8&quot; T-1-11 or 3/8&quot; CDX (Minimum)</td>
</tr>
<tr>
<td>24</td>
<td>1/4&quot; (24/16 span rating) CDX (Minimum)¹</td>
</tr>
<tr>
<td>32</td>
<td>5/8&quot; (40/20 span rating) CDX (Minimum)²</td>
</tr>
</tbody>
</table>

¹ DPNR recommends 5/8" CDX (Minimum)
² DPNR recommends 3/4" CDX (Minimum)
3x6 Rafter @ 24" OC.

2x6 Blocking between rafters

15# Pldg. Felt

Hurricane Straps

Existing Bond Beam

Detail for new rafters tied-down to existing bond beam

Roof, see roof details

2-3/8" Shear Flank Cont. Anchor Bolts - Staggered to bond beam

8" Conc Block

Wrap around tie-down straps both sides of exist rafter

2-5/8" Exp. Anchors @ 18" OC (Stagger BP & Bottom)

Roof tie down - retrofit
#4 BAR THRU EACH RAFTER

NOTE:

1) FOR END RAFTER, A MECHANICAL TIE DOWN MUST BE PROVIDED TIEING THE RAFTER TO THE BOND BEAM, SUCH AS A "ETA 20 EMBED CONNECTOR INTO THE BOND BEAM AND NAIL TO THE RAFTERS.

2) THIS DETAIL IS LIMITED TO 3X RAFTERS UNLESS HOUSE WIDTH IS LESS THAN 24'.

3) THE #4 HORIZONTAL BAR IS LIMITED TO 2\frac{1}{2}" CLEAR FROM TOP OF RAFTER.
Examples of Recommended Hurricane Roof Connectors

(Crafters supported on stud wall and studs to be plates)

Note:

Loads indicated are connector uplift capacity in pounds. 1/3 increase for wind loading has been considered.
NOTES:

1. PER. TABLE 602.7, 1995 CODE —
   WALL BRACING PER MULTIPLE STORY HOME

2. PER. TABLE 602.3, 1995 CODE —

3. NAILING: 8d GALV. NAILS, EDGE, EDGE, EDGE
   INTERMEDIATE SUPPORTS
   OR SCREW, 10x2½" C/F 18" C INTERMEDIATE.

STRUCTURAL SHEATHING
HEIGHT DEFINITIONS - C.A.B.O.

32' or 10 M. MAX. HEIGHT

OPEN PORCH

LOWER LEVEL: CISTERN, ETC.

COLUMN

SEISMIC CONDITIONS MAY REQUIRE SPECIAL FOUNDATIONS.

FOUNDATION WALL

EMBED FTG. PER CODE.

NOT MORE THAN 3 STORIES. CABO CH. 2, SECTION 202
WINDOW SHUTTERS & BLINDS.

JALOUSIE TYPE (LOUVER) SHUTTERS

ANCHOR TO FRAME IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS

GLASS LOUNES ARE NOT RECOMMENDED.

ANCHOR TO FRAME IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION.

SHUTTER OR BLIND OF 1/8" THICKNESS (MIN)
FOR COTTON SURFACE BOLTS TO SECURE WHEN CLOSED

ELEVATION: 20 1/2" x 3 1/4" x 2"
Publication: "Taking Charge: Low Cost Housing and Squatting in S.E. Asia" as published in Self-Help Housing, Ministry of Housing and Construction, Victoria, and Department of Architecture and Building, University of Melbourne, Australia, 1988

Involvement: Authorship of a paper dealing with self-help housing and squatting in developing Asian countries.

Summary: This paper reviewed, using case studies, the magnitude of the low-income housing unit, squatting problems, and proposes some physical low-cost solutions to this complex problem.

Purpose: To offer suggestions to low-income settlements and government agencies to improve housing conditions for poor households, including squatters. Physical planning and design solutions are identified using available human resources as amenities rather than problems in low-income communities.

Benefits to TAMU/ College of Architecture:

Knowledge derived from years of research into this global problem is brought into the studio setting for purposes of analyses and design of low cost housing, especially in the fringe areas of American cities; this paper has been delivered to A.C.S.A. and the World Congress on Housing in Singapore to influence government housing authorities and adds to the body of knowledge in our Technical Reference Center for students wishing to learn more about issues of low cost housing in developing countries.