BRACED WALL PANELS (BWP)
ENGINEERING PRINCIPLES

1. FORCES
2. PRINCIPLE FAILURE MODES
3. DEFINITIONS
4. 3 METHODS SHEAR WALL OF ANALYSIS
FORCES

PERPENDICULAR WIND

SEISMIC AND LATERAL WIND
PRINCIPLE
FAILURE MODES

ROTATION

TRANSLATION

RACKING
“SHEAR WALL”

IS

“AN INTERIOR OR EXTERIOR WALL ENGINEERED TO RESIST LATERAL LOADS”
“BRACED WALL PANEL”

IS

THE “PRESCRIPTIVE EQUIVALENT” TO A SHEAR WALL
THREE METHODS OF ENGINEERED SHEAR WALL ANALYSIS

SEGMENTED

PERFORATED

PORTAL FRAME

EACH METHOD REQUIRES:
- HOLD-DOWNS FOR UPLIFT
- ANCHOR BOLTS FOR TRANSLATION (SHEAR)
BRACED WALL PANELS – SIMPLE AS...3,4,5,6...
i.e. §602.10.3, 4, 5, 6
IRC §602.10.3
PRESCRIPTIVE BWP METHODS

1. LET IN BRACING
2. DIAGONAL BOARDS
3. OSB OR PLYWOOD
4. STRUCTURAL FIBERBOARD (INTERMEDIATE SHEATHING)
5. GYP BOARD
6. PARTICLEBOARD
7. PORTLAND CEMENT PLASTER
8. HARDBOARD
### TABLE 602.10.3

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>TYPE OF BRACE</th>
<th>AMOUNT OF BRACING</th>
</tr>
</thead>
</table>
| | Methods 1, 2, 3, 4, 5, 6, 7 or 8 | Located at each end  
At least every 25’ on center  
Not less than 16% of braced wall line. |
| | Methods 1, 2, 3, 4, 5, 6, 7 or 8 | Located at each end  
At least every 25’ on center  
Not less than 16% of BWL - Method 3  
25% of BWL - Methods 2 4 5 6 7 8 |
| | Methods 2, 3, 4, 5, 6, 7 or 8 | Minimum 48 inches wide panels located at each end  
At least every 25’ on center  
Not less than 25% of BWL - Method 3  
35% of BWL - Methods 2 4 5 6 7 8 |
IRC §602.10.4
SEISMIC A-B and < 100 MPH WINDS

• 48” PANELS
• 12’ CORNERS
• 25’ O.C.
• 16-25-35% OF THE BWL
  DEPENDING ON WALL LOCATION AND NUMBER OF FLOORS
• MIXING AND MATCHING ALLOWED
EXAMPLE 1 - BWP @ CORNERS

A + B + C >= 16% OF BWL

<= 25'-0"

<= 25'-0"

A

48"

EXAMPLE 2 - BWP AWAY FROM CORNERS

A+B>=16% OF BWL

<= 25'-0"

<= 12'-0"

A

48"

B

48"
MIX AND MATCHING METHODS 1-8 ALLOWED
BRACED WALL PANELS
METHODS 1-8

EQUIVALENT TO
SEGMENTED SHEAR WALLS
SO WHAT HAPPENS IF YOU DON’T HAVE 48”?
§602.10.3&4 METHODS 1-8
48” PANELS
12’ FROM CORNERS
25” O.C.
MIX AND MATCH

§602.10.5

CONSIDER NEXT
ALTERNATIVE

§602.10.6
IRC §602.10.5

CONTINUOUS OSB (OVER THE WHOLE HOUSE)

ALLOWS REDUCTION FROM 48” PANEL REQUIREMENT

PANEL WIDTH IS FUNCTION OF:
• THE ADJACENT OPENING HEIGHTS
• 8’,9’,10’ STUD HEIGHT

BY DEFINITION - CANNOT MIX & MATCH WITH 8 PRESCRIPTIVE METHODS

CORNERS TO BE OVERLAPPED
### IRC §602.10.5

**CONTINUOUS OSB** *(WHOLE HOUSE)*

<table>
<thead>
<tr>
<th>OPENING HEIGHT</th>
<th>8' STUDS</th>
<th>9' STUDS</th>
<th>10' STUDS</th>
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<tbody>
<tr>
<td>5'-0&quot;</td>
<td>24&quot;</td>
<td>27&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td>28&quot;</td>
<td>28&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>6'-8&quot; DOOR</td>
<td>31&quot;</td>
<td>31&quot;</td>
<td>31&quot;</td>
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<tr>
<td>7'-0&quot;</td>
<td>35&quot;</td>
<td>33&quot;</td>
<td>33&quot;</td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td>48&quot;</td>
<td>39&quot;</td>
<td>38&quot;</td>
</tr>
<tr>
<td>9'-0&quot;</td>
<td></td>
<td>54</td>
<td>47</td>
</tr>
<tr>
<td>10'-0&quot;</td>
<td></td>
<td></td>
<td>60</td>
</tr>
</tbody>
</table>

BWP WIDTH IS A FUNCTION OF OPENING HT TO STUD HT
CANNOT MIX AND MATCH METHODS 1-8 WITH §602.10.5 CONTINUOUS OSB/PLYWOOD
§602.10.5 MUST STAND ON ITS OWN

CONTINUOUS OSB/PLYWOOD
§602.10.5 - CONTINUOUS OSB
OVERLAP OSB OR PLYWOOD SHEATHING AT CORNERS

(FROM IRC FIGURE 602.10.5)

OUTSIDE CORNER

16d NAILS @ 24" O.C.

OVERLAP SHEATHING

8d NAILS @ 12" O.C. ON ALL FRAMED MEMBERS NOT AT PANEL EDGES (FIELD)

8d NAILS @ 6" O.C. ON ALL PANEL EDGES

INSIDE CORNER

8d NAILS @ 6" O.C. ON ALL PANEL EDGES

16d NAIL AT 24" O.C.

8d NAILS @ 12" O.C. ON ALL FRAMED MEMBERS NOT AT PANEL EDGES (FIELD)
BRACED WALL PANELS USING CONTINUOUS OSB

EQUIVALENT TO PERFORATED SHEAR WALLS
§602.10.5
CONTINUOUS OSB
24”, 27”, 30” PANELS
NO MIX AND MATCH
NO HOLD-DOWNS
OVERLAPPED CORNERS

§602.10.6

§602.10.3&4 METHODS 1-8
48” PANELS
12’ FROM CORNERS
25” O.C.
MIX AND MATCH

AND WHAT IF THAT IS TOO EXPENSIVE?
§602.10.5
CONTINUOUS OSB
24”, 27”, 30” PANELS
NO MIX AND MATCH
NO HOLD-DOWNS
OVERLAPPED CORNERS

§602.10.6

CONSIDER ANOTHER ALTERNATIVE
§602.10.6 ALTERNATIVE METHOD REPLACES ANY METHOD 1-8, 48” PANEL

REQUIRES:

- 32” OSB PANEL
- MAX 10’ STUDS
- SPECIAL NAILING AND BLOCKING
- SPECIAL A.B. BOLTS & HOLD-DOWNS
- SPECIAL FOOTINGS & REBAR
§602.10.6 – CAN REPLACE ANY 48” BWP
ALTERNATIVE METHOD

EQUIVALENT TO SEGMENTED SHEAR WALLS
§602.10.5 CONTINUOUS OSB
24”, 27”, 30” PANELS
NO MIX AND MATCH
NO HOLD-DOWNS
OVERLAPPED CORNERS

§602.10.6 OSB ALTERNATIVE METHOD
32” PANELS
MIX AND MATCH
HOLD-DOWNS
OTHER REQUIREMENTS

§602.10.3&4 METHODS 1-8
48” PANELS
12’ FROM CORNERS
25” O.C.
MIX AND MATCH

AND WHAT IF THAT STILL DOESN’T HELP??
§602.10.5 CONTINUOUS OSB 24”, 27”, 30” PANELS
NO MIX AND MATCH
NO HOLD-DOWNS
OVERLAPPED CORNERS

§602.10.6 OSB ALTERNATIVE METHOD 32” PANELS
MIX AND MATCH
HOLD-DOWNS
OTHER REQUIREMENTS

§602.10.3&4 METHODS 1-8
48” PANELS
12’ FROM CORNERS
25” O.C.
MIX AND MATCH

ENGINEERED SHEAR WALLS
ENGINEERED SHEAR WALLS

- MUST BE MODEL SPECIFIC
- NO CALCULATIONS REQUIRED
- MUST SPECIFY SHEAR WALL METHOD OF ANALYSIS:
  - SEGMENTED, PERFORATED, PORTAL
- DRAWING DETAILS:
  - ANCHOR BOLTS AND HOLD-DOWNS (IF REQD)
  - SHEATHING ON THE SHEAR WALL
  - NAILING PATTERN
  - FRAMING MEMBERS, DETAILS FOR BOTH ENDS OF SHEAR WALL
- FOR 2-STORY ROOMS, ENGINEER MUST DESIGN FOR BOTH NORMAL AND LATERAL LOADS
§602.10.5 CONTINUOUS OSB
24”, 27”, 30” PANELS
NO MIX AND MATCH
NO HOLD-DOWNS
OVERLAPPED CORNERS

§602.10.6 OSB ALTERNATIVE METHOD
32” PANELS
MIX AND MATCH
HOLD-DOWNS
OTHER REQUIREMENTS

§602.10.3&4 METHODS 1-8
48” PANELS
12’ FROM CORNERS
25” O.C.
MIX AND MATCH

ENGINEERED SHEAR WALLS
NO CLCS, SITE SPECIFIC
SPEC ANALYSIS METHOD
SPEC A.B. AND HOLD-DOWNS
SPEC NAILING & DETAILS

THAT’S ALSO EXPENSIVE.
ARE THERE ANY OTHER CHOICES?
§602.10.3&4 METHODS 1-8
48” PANELS
12’ FROM CORNERS
25” O.C.
MIX AND MATCH

§602.10.5
CONTINUOUS OSB
24”, 27”, 30” PANELS
NO MIX AND MATCH
NO HOLD-DOWNS
OVERLAPPED CORNERS

§602.10.6
OSB ALTERNATIVE METHOD
32” PANELS
MIX AND MATCH
HOLD-DOWNS
OTHER REQUIREMENTS

ENGINEERED SHEAR WALLS
NO CLCS, SITE SPECIFIC
SPEC ANALYSIS METHOD
SPEC A.B. AND HOLD-DOWNS
SPEC NAILING & DETAILS

SPECIALIZED PRODUCTS
ENGINEERED PRODUCTS

TESTED PRODUCTS:

• SIMPSON STRONG WALL
• HARDY FRAME SHEAR WALL
• SIMPSON LET-IN BRACING
• OTHERS
HARDY WALL
§602.10.5 CONTINUOUS OSB 24”, 27”, 30” PANELS NO MIX AND MATCH NO HOLD-DOWNS OVERLAPPED CORNERS

§602.10.6 OSB ALTERNATIVE METHOD 32” PANELS MIX AND MATCH HOLD-DOWNS OTHER REQUIREMENTS

§602.10.3&4 METHODS 1-8 48” PANELS 12’ FROM CORNERS 25” O.C. MIX AND MATCH

BUT ISN’T THERE SOMETHING SMALLER THAN 24” – HELP!!

ENGINEERED SHEAR WALLS NO CALCS, SITE SPECIFIC SPEC ANALYSIS METHOD SPEC A.B. AND HOLD-DOWNS SPEC NAILING & DETAILS

SPECIALIZED PRODUCTS
§602.10.5 CONTINUOUS OSB 24”, 27”, 30” PANELS NO MIX AND MATCH NO HOLD-DOWNS OVERLAPPED CORNERS

§602.10.6 OSB ALTERNATIVE METHOD 32” PANELS MIX AND MATCH HOLD-DOWNS OTHER REQUIREMENTS

§602.10.3&4 METHODS -8 48” PANELS 12’ FROM CORNERS 25” O.C. MIX AND MATCH

SPECIAL AGENCIES

ENGINEERED SHEAR WALLS NO CALCS, SITE SPECIFIC SPEC ANALYSIS METHOD SPEC A.B. AND HOLD-DOWNS SPEC NAILING & DETAILS

SPECIALIZED PRODUCTS
TESTING AGENCY DESIGNS
AMERICAN PLYWOOD ASSOCIATION
TT-073A PORTAL FRAME BRACING

- 16”-18”-20” (6:1) FOR ONE STORY OR ROOF
- 24”-27”-30” (4:1) FOR ONE STORY AND ROOF
- REQUIRES MASONRY OR CONCRETE FOUND.
- (2) SIMPSON 4200# HOLD-DOWNS INTO CONC.
- (1) ½” A.B. WITH 2”x2”x3/16” SQUARE WASHER
- HEADER BEAM OVER PANEL
- SPECIAL NAILING AND 1000# STRAP INTO S.PINE
- CAN BE MIXED WITH METHODS 1-8
TT-073A USE ANY PLACE ON HOUSE WITH ANY METHOD 1-8 REQUIRES HOLD-DOWNS + A.B.
TESTING AGENCY DESIGNS
AMERICAN PLYWOOD ASSOCIATION
TT-077A PORTAL FRAME BRACING

• APPLIES TO GARAGES ONLY
• REQUIRES CONTINUOUS OSB ON THE HOUSE
• THEREFORE CANNOT BE MIXED WITH METHODS 1-8
• 16”-18”-20” (6:1) FOR 8’, 9’, 10’ STUDS
• (2) ½” A.B. WITH 2”x2”x3/16” SQUARE WASHERS
• HEADER BEAM OVER PANEL
• SPECIAL NAILING AND 1000# STRAP INTO S.PINE
• NO HOLD-DOWNS REQUIRED
APA 077A FOR GARAGES W/ CONT OSB

- CONTINUOUS OSB
- HEADER EXTENDED OVER JACKS
- WRAPPED CORNERS
- (2) ANCHOR BOLTS W/ SPECIAL WASHERS
- NO HOLD-DOWNS REQD
APA 077A FOR GARAGES W/ CONT OSB
PORTAL FRAME
CONTINUOUS OSB

SIMILAR TO
PERFORATED
SHEAR WALLS
§602.10.3 & 4
48” PANELS
12’ FROM CORNERS
25” O.C.
MIX AND MATCH

§602.10.5
CONTINUOUS OSB
24”, 27”, 30” PANELS
NO MIX AND MATCH
NO HOLD-DOWNS
OVERLAPPED CORNERS

§602.10.6
OSB ALTERNATIVE METHOD
32” PANELS
MIX AND MATCH
HOLD-DOWNS
OTHER REQUIREMENTS

APA 77A
GARAGES ONLY
OSB WHOLE HOUSE
16”-18”-20” PANELS
NO HOLD-DOWNS
SPECIAL DETAILS

APA 73A
ANY PLACE ON HOUSE
REPLACES ANY METHOD
16”-18”-20” / 24”-27”-30”
HOLD-DOWNS
SPECIAL DETAILS

ENGINEERED SHEAR WALLS
NO CALCS, SITE SPECIFIC
SPEC ANALYSIS METHOD
SPEC A.B. AND HOLD-DOWNS
SPEC NAILING & DETAILS

THOSE ARE REALLY CUMBERSOME HOLD-DOWNS!!!
§602.10.5 CONTINUOUS OSB
24”, 27”, 30” PANELS
NO MIX AND MATCH
NO HOLD-DOWNS
OVERLAPPED CORNERS

§602.10.6 OSB ALTERNATIVE METHOD
32” PANELS
MIX AND MATCH
HOLD-DOWNS
OTHER REQUIREMENTS

APA 77A
GARAGES ONLY
OSB WHOLE HOUSE
16”-18”-20” PANELS
NO HOLD-DOWNS
SPECIAL DETAILS

APA 73A
ANY PLACE ON HOUSE
REPLACES ANY METHOD
16”-18”-20” / 24”-27”-30”
HOLD-DOWNS
SPECIAL DETAILS

ENGINEERED SHEAR WALLS
NO CALCS, SITE SPECIFIC
SPEC ANALYSIS METHOD
SPEC A.B. AND HOLD-DOWNS
SPEC NAILING & DETAILS

§602.10.3&4 METHODS 1-8
48” PANELS
12’ FROM CORNERS
25” O.C.
MIX AND MATCH

SPECIALIZED PRODUCTS

EQUIVALENT HOLD-DOWN
EQUIVALENT HOLD-DOWN

TT-073 PORTAL FRAME BRACING

• REQUIRES 4200# HOLD-DOWN EQUIVALENT:
  • (2) 3/4” THREADED ROD INTO CONCRETE FOOTING WITH ANY SIMPSON SUITABLE HOLD-DOWN
  • (2) 3/4” SIMPSON “CURLY” A.B. INTO:
    • CONC. FOOTING OR,
    • INTO 8” SOLID GROUTED CMU
      PER SIMPSON REQUIREMENTS

• NO OTHER A.B. REQUIRED
§602.10.5 CONTINUOUS OSB 24”, 27”, 30” PANELS NO MIX AND MATCH NO HOLD-DOWNS OVERLAPPED CORNERS

APA 77A GARAGES ONLY OSB WHOLE HOUSE 16”-18”-20” PANELS NO HOLD-DOWNS SPECIAL DETAILS

ENGINEERED SHEAR WALLS NO CALCS, SITE SPECIFIC SPEC ANALYSIS METHOD SPEC A.B. AND HOLD-DOWNS SPEC NAILING & DETAILS

SPECIALIZED PRODUCTS

§602.10.6 OSB ALTERNATIVE METHOD 32” PANELS MIX AND MATCH HOLD-DOWNS OTHER REQUIREMENTS

APA 73A ANY PLACE ON HOUSE REPLACES ANY METHOD 16”-18”-20” / 24”-27”-30” HOLD-DOWNS SPECIAL DETAILS

EQUIVALENT HOLD-DOWN

BWP SIMPLE AS 3,4,5,6….

§602.10.3&4 METHODS 1-8 48” PANELS 12’ FROM CORNERS 25” O.C. MIX AND MATCH
<table>
<thead>
<tr>
<th>METHOD</th>
<th>MIN BWP WIDTH ALLOWED</th>
<th>MIX &amp; MATCH</th>
<th>HOLD-DOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,3,4,5,6,7,8</td>
<td>48”</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>602.10.5 CONT OSB W/ OVERLAP CORNERS</td>
<td>24”-27”-30”</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>602.10.6 ALTERNATE</td>
<td>32”</td>
<td>YES</td>
<td>1800#</td>
</tr>
<tr>
<td>ENGINEERED</td>
<td>ENGR</td>
<td>ENGR</td>
<td>ENGR</td>
</tr>
<tr>
<td>SPEC PRODUCT</td>
<td>MFGR</td>
<td>MFGR</td>
<td>MFGR</td>
</tr>
<tr>
<td>APA TT-073A (OR EQUIVALENT)</td>
<td>16”-18”-20” (1 STORY) 24”-27”-30” (1ST OF 2 STORY)</td>
<td>YES</td>
<td>4200#</td>
</tr>
<tr>
<td>APA TT-077A GARAGES</td>
<td>16”-18”-20”</td>
<td>NO - OSB ONLY</td>
<td>NO</td>
</tr>
</tbody>
</table>
SPECIAL SITUATIONS
1. GABLES AND DORMERS DO NOT HAVE TO BE BRACED EXCEPT HABITABLE PORTION
2. BAY WINDOWS < 8’ PROJECTION DO NOT HAVE TO BE BRACED IF THERE ARE OTHER BWPs TO DO THE JOB
3. RECESSES (e.g. FOYER) < 8’ WIDE DO NOT NEED TO BE BRACED
4. GAS FIREPLACE PROJECTIONS CAN BE USED AS BWP (IF NECESSARY) PROVIDED THE FLOOR JOISTS ARE BLOCKED AND SHEATHING IS NAILED INTO BLOCKING
5. FLORIDA ROOMS >8’ DEEP MUST BE BRACED
6. FLORIDA ROOM CONVERSIONS DO NOT HAVE TO COMPLY, BUT NEW ADDITIONS OR DETACHED STRUCTURES MUST COMPLY
PLAN REVIEW GUIDELINES

1. BWP METHOD(S) MUST BE WRITTEN ON THE FIRST FLOOR PLAN

2. IF USING METHOD 3 (48” OSB), SHOW EXACTLY WHERE THE BWPs ARE TO BE PLACED

3. IF USING METHOD 2,4,5,6,7,8: IT WILL BE ASSUMED TO BE CONTINUOUS OVER THE WHOLE HOUSE, OTHERWISE SHOW WHERE THE BWPs ARE TO BE PLACED.

4. SPECIFY THE LOCATIONS FOR ALL OTHER SPECIAL METHODS
METHOD 602.10.5
EXCEPT WHERE SHOWN

APA
TT-077A

SEE ENGR. DESIGN
FOOTNOTES:
PICTURES AND SKETCHES FROM
APA,
WCA,
IRC