
BRACED WALL PANELS (BWP)
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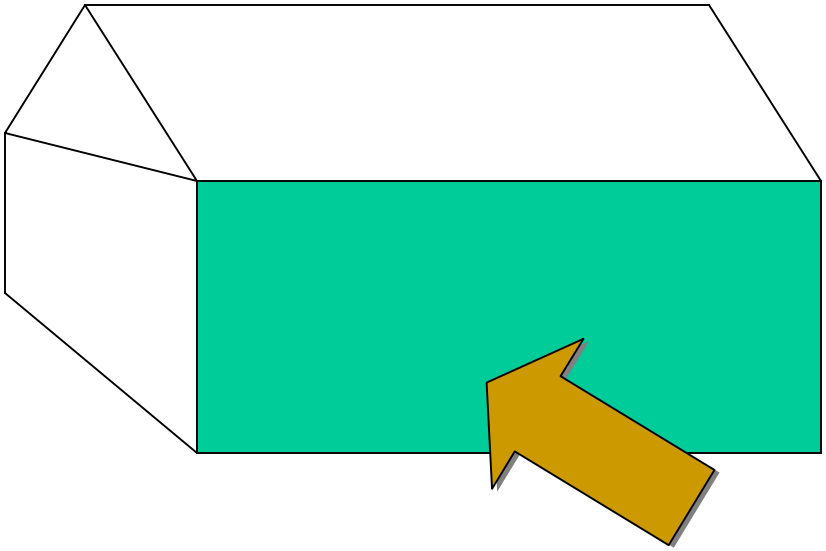
ENGINEERING PRINCIPLES

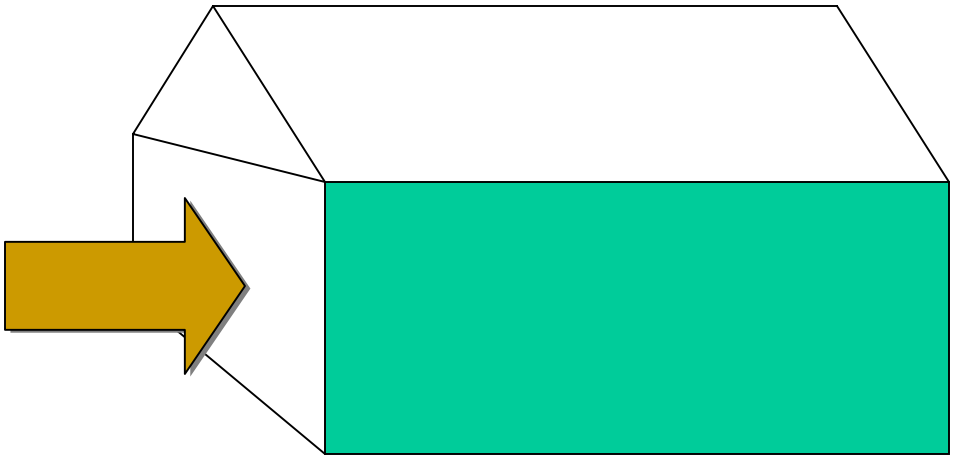
1. FORCES
2. PRINCIPLE FAILURE MODES
3. DEFINITIONS
4. 3 METHODS SHEAR WALL OF ANALYSIS

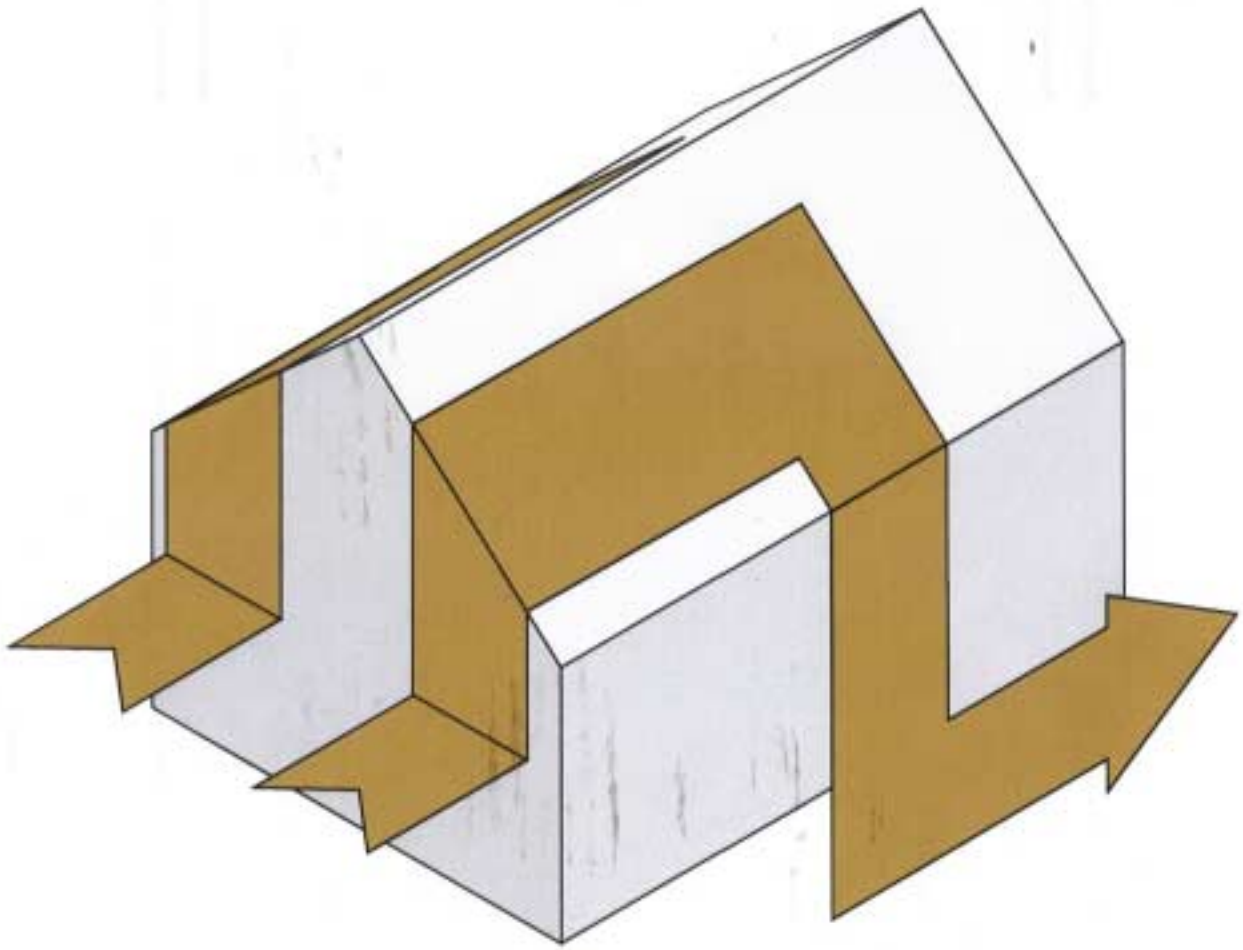
FORCES

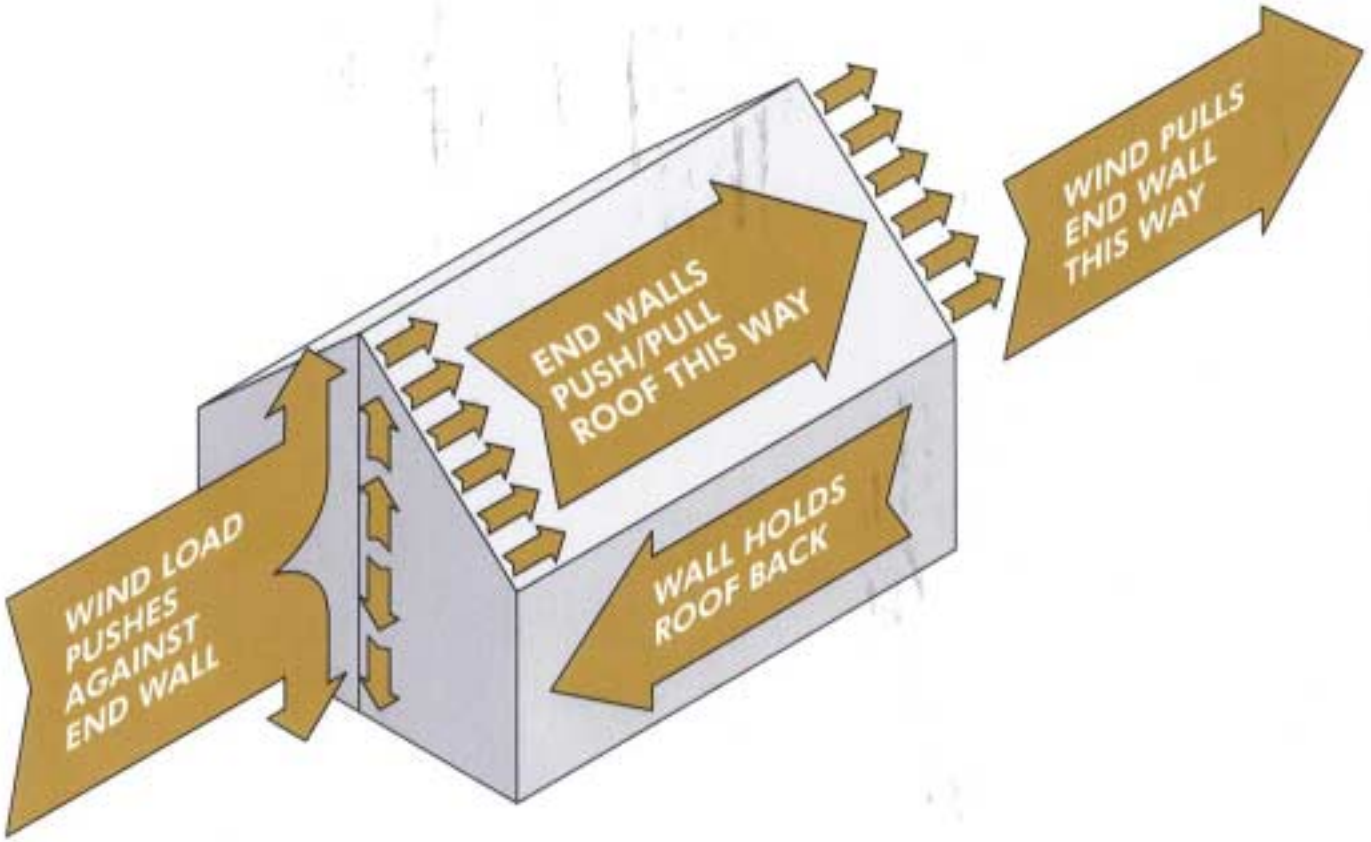


PERPENDICULAR WIND

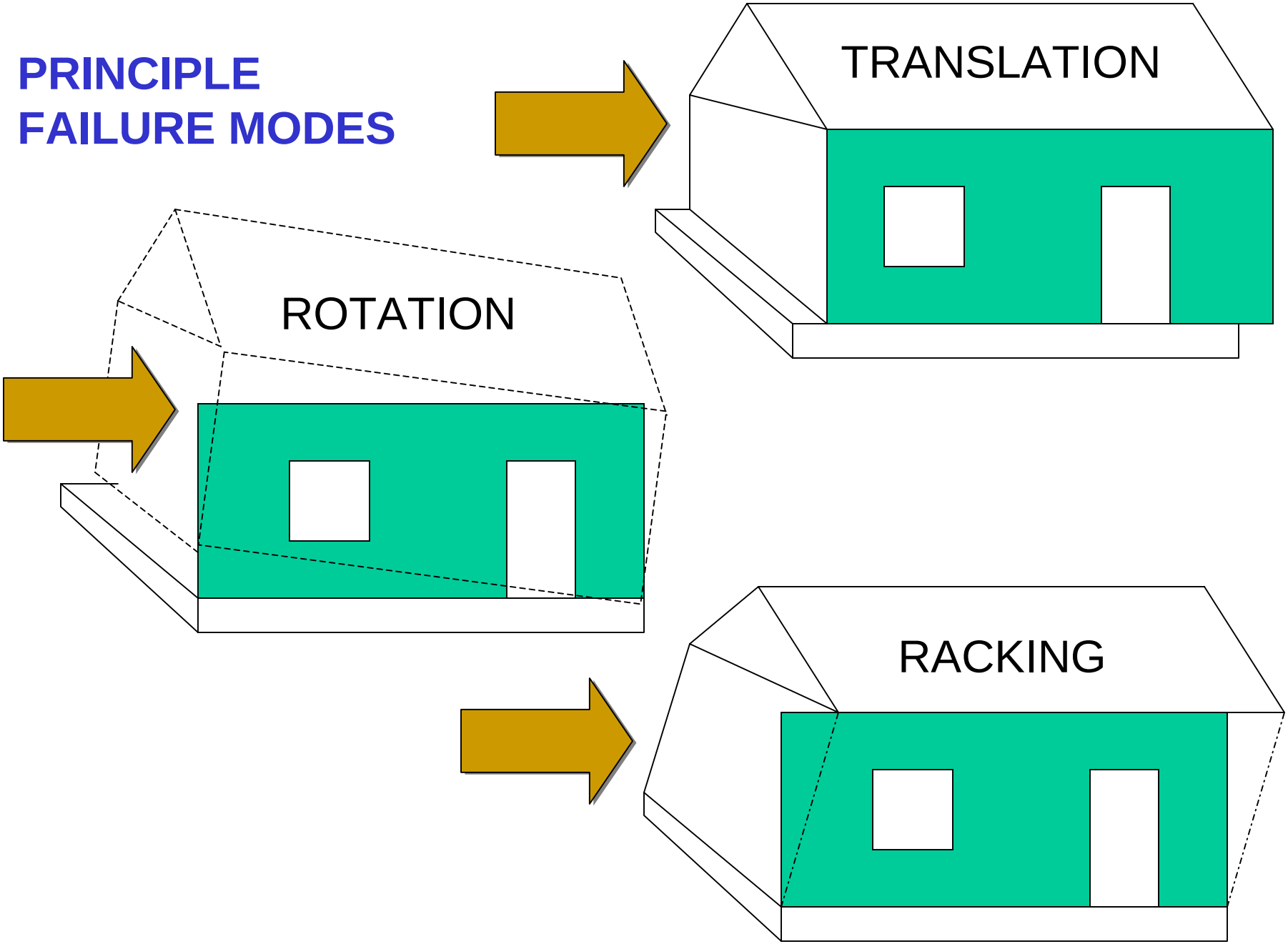
SEISMIC AND LATERAL WIND






WIND LOAD
PUSHES
AGAINST
END WALL
END WALLS
PUSH/PULL
ROOF THIS WAY
WALL HOLDS
ROOF BACK
WIND PULLS
END WALL
THIS WAY

PRINCIPLE FAILURE MODES



“SHEAR WALL”

IS

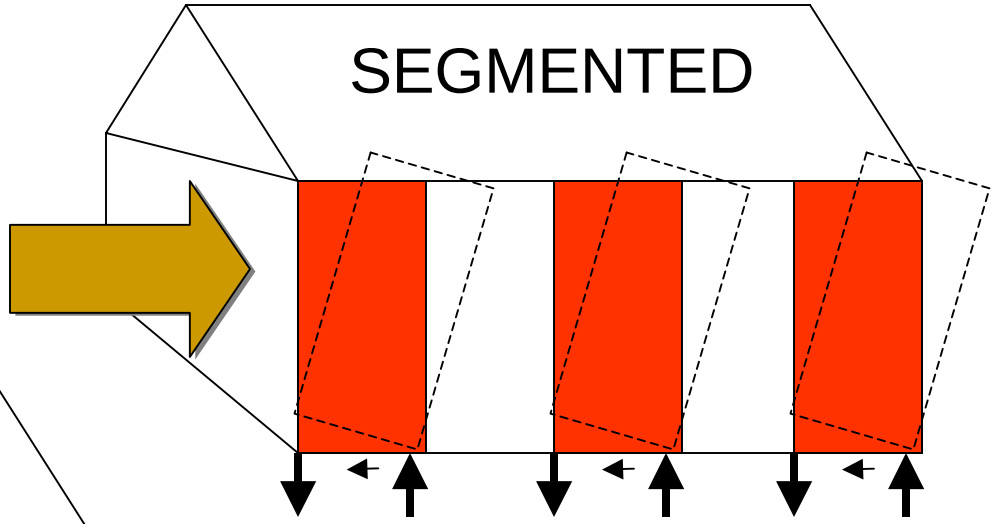
“AN INTERIOR OR EXTERIOR WALL ENGINEERED TO RESIST LATERAL LOADS”

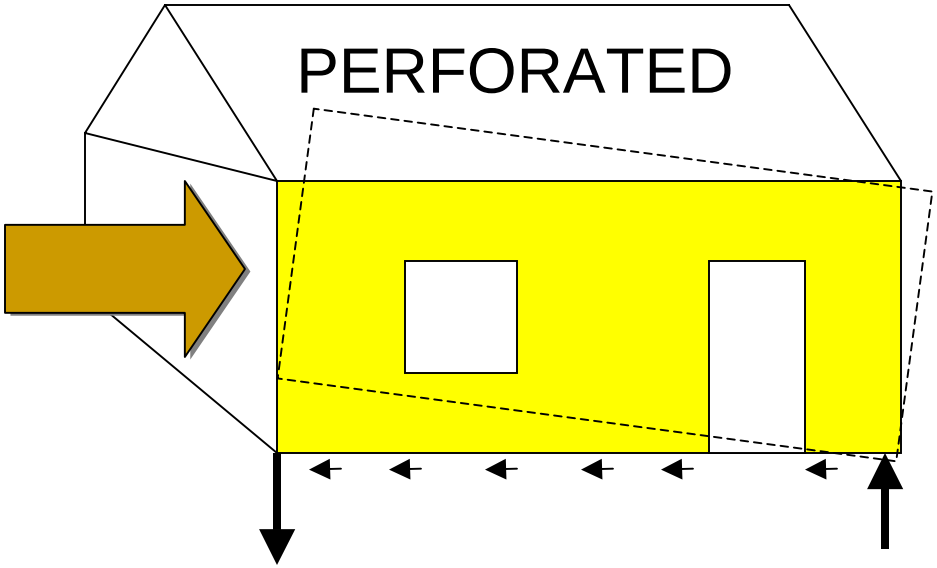
“BRACED WALL PANEL”

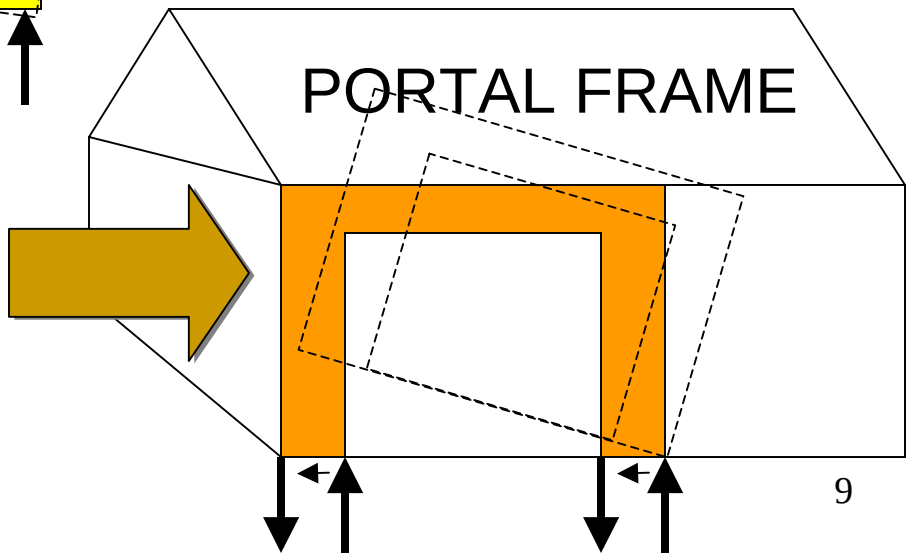
IS

THE “PRESCRIPTIVE EQUIVALENT” TO A SHEAR WALL

THREE METHODS OF ENGINEERED SHEAR WALL ANALYSIS



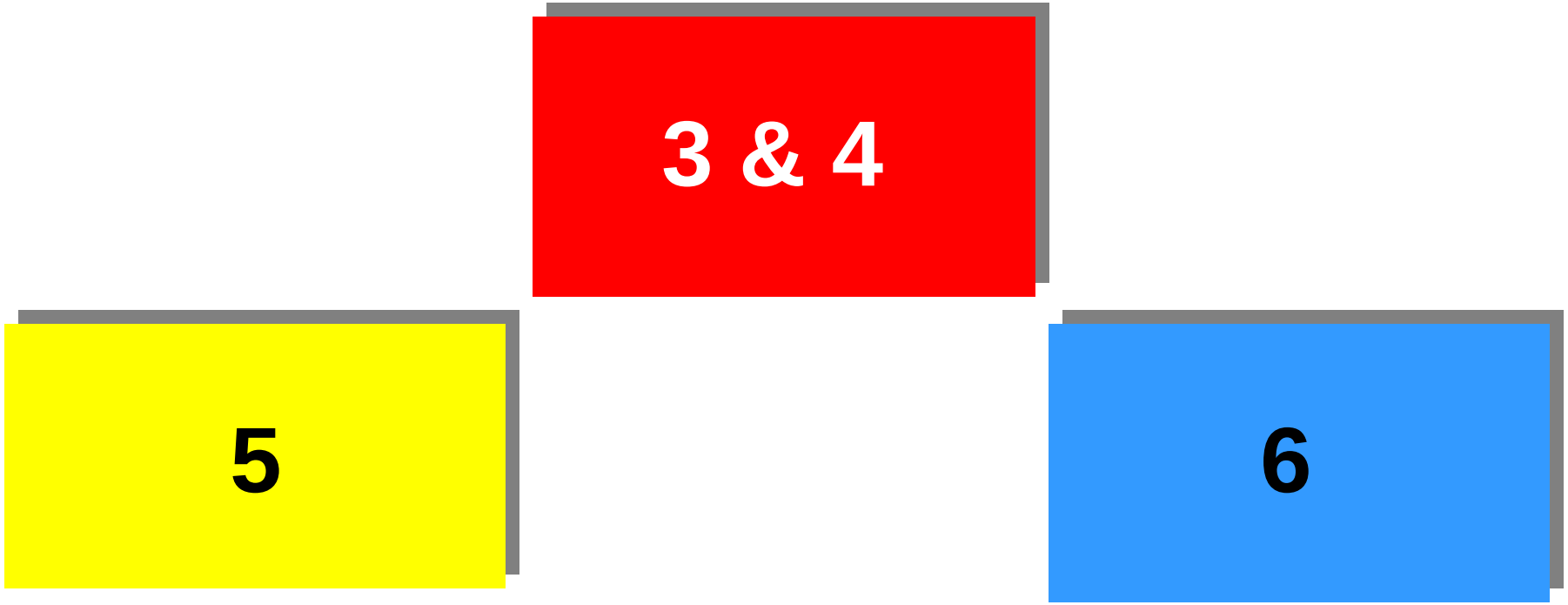




EACH METHOD REQUIRES:

•HOLD-DOWNS FOR UPLIFT

•ANCHOR BOLTS FOR TRANSLATION (SHEAR)



BRACED WALL PANELS – SIMPLE AS…3,4,5,6…

IRC

§602.10.3 & 4

IRC

§602.10.5

IRC

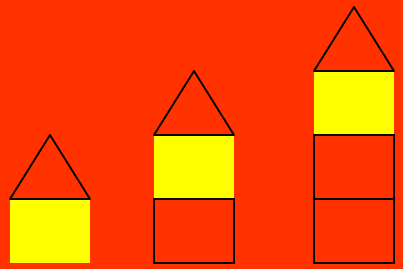
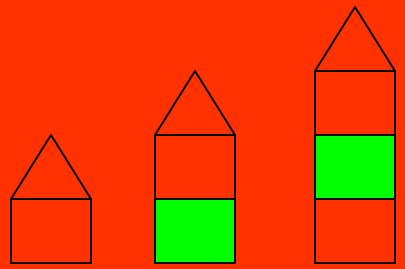
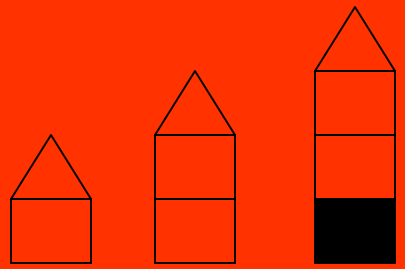
§602.10.6

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

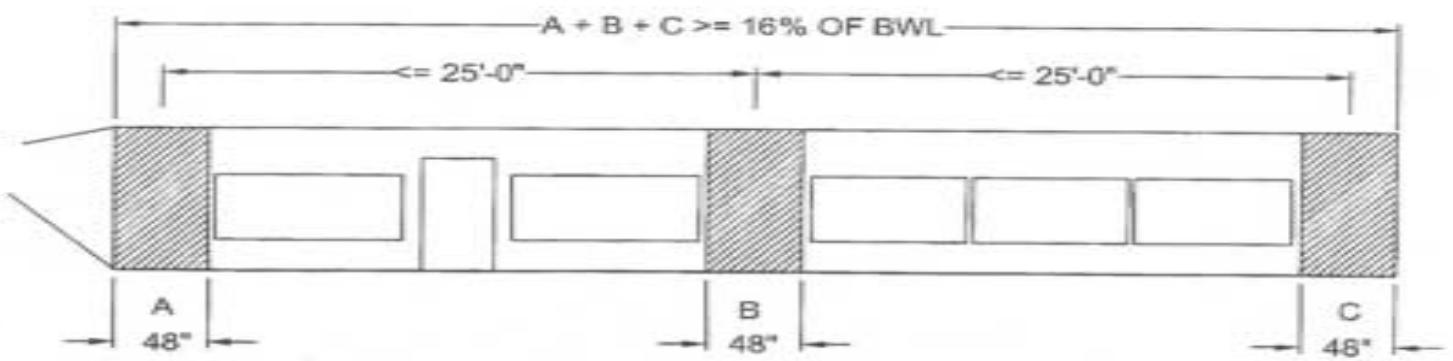
CONDITION	TYPE OF BRACE	AMOUNT OF BRACING
	Methods 1, 2, 3, 4, 5, 6, 7or 8	• Located at each end • At least every 25’ on center • Not less than 16% of braced wall line.
	Methods 1, 2, 3, 4, 5, 6, 7or 8	• Located at each end • At least every 25’ on center • Not less than 16% of BWL - Method 3 25% of BWL - Methods 2 4 5 6 7 8
	Methods 2, 3, 4, 5, 6, 7or 8	• Minimum 48inches 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

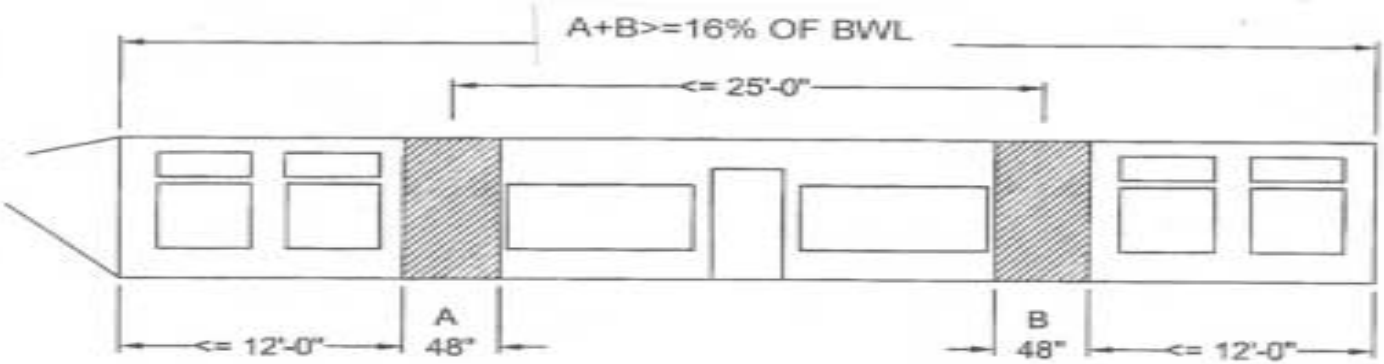
SEISMIC A-B and < 100 MPH WINDS

- 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

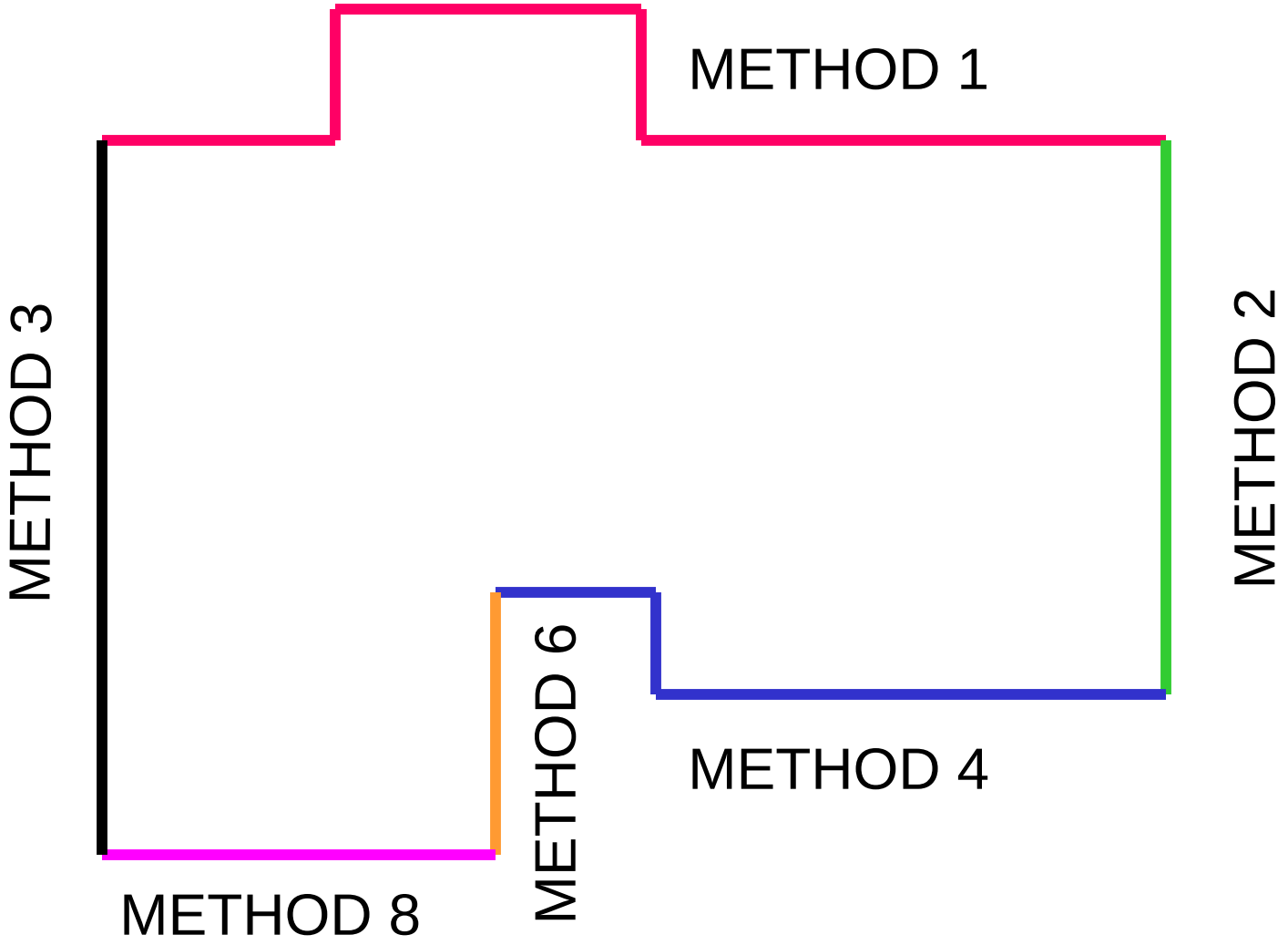
EXAMPLE 1 - BWP @ CORNERS



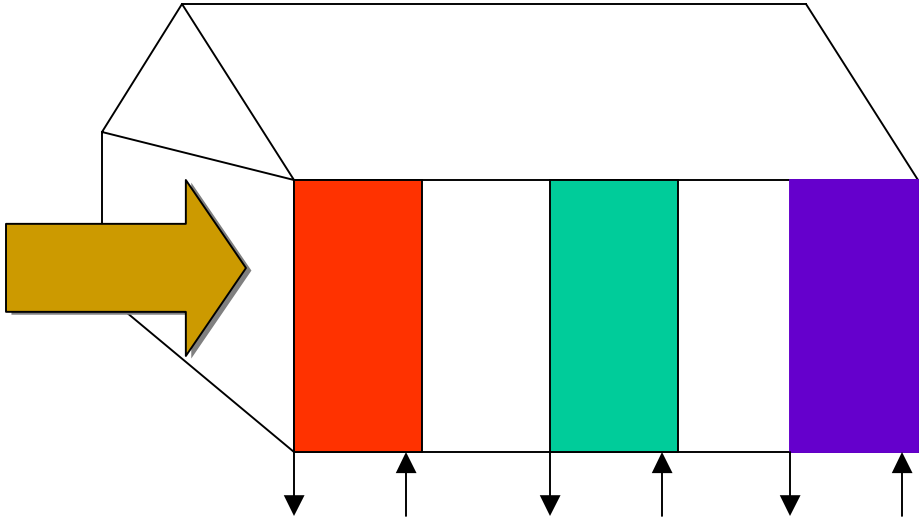
EXAMPLE 2 - BWP AWAY FROM CORNERS



MIX AND MATCHING METHODS 1-8 **ALLOWED**



BRACED WALL PANELS
METHODS 1-8



EQUIVALENT TO

SEGMENTED SHEAR WALLS

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

§602.10.5

§602.10.6

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

§602.10.6

CONSIDER NEXT ALTERNATIVE

IRC §602.10.5

CONTINUOUS OSB (OVER THE WHOLE HOUSE)

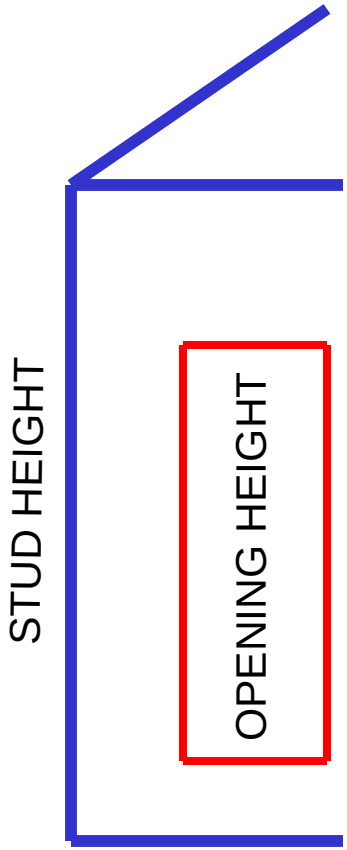
ALLOWS REDUCTION FROM 48" PANEL REQUIREMENT

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



BWP WIDTH IS A FUNCTION OF OPENING HT TO STUD HT

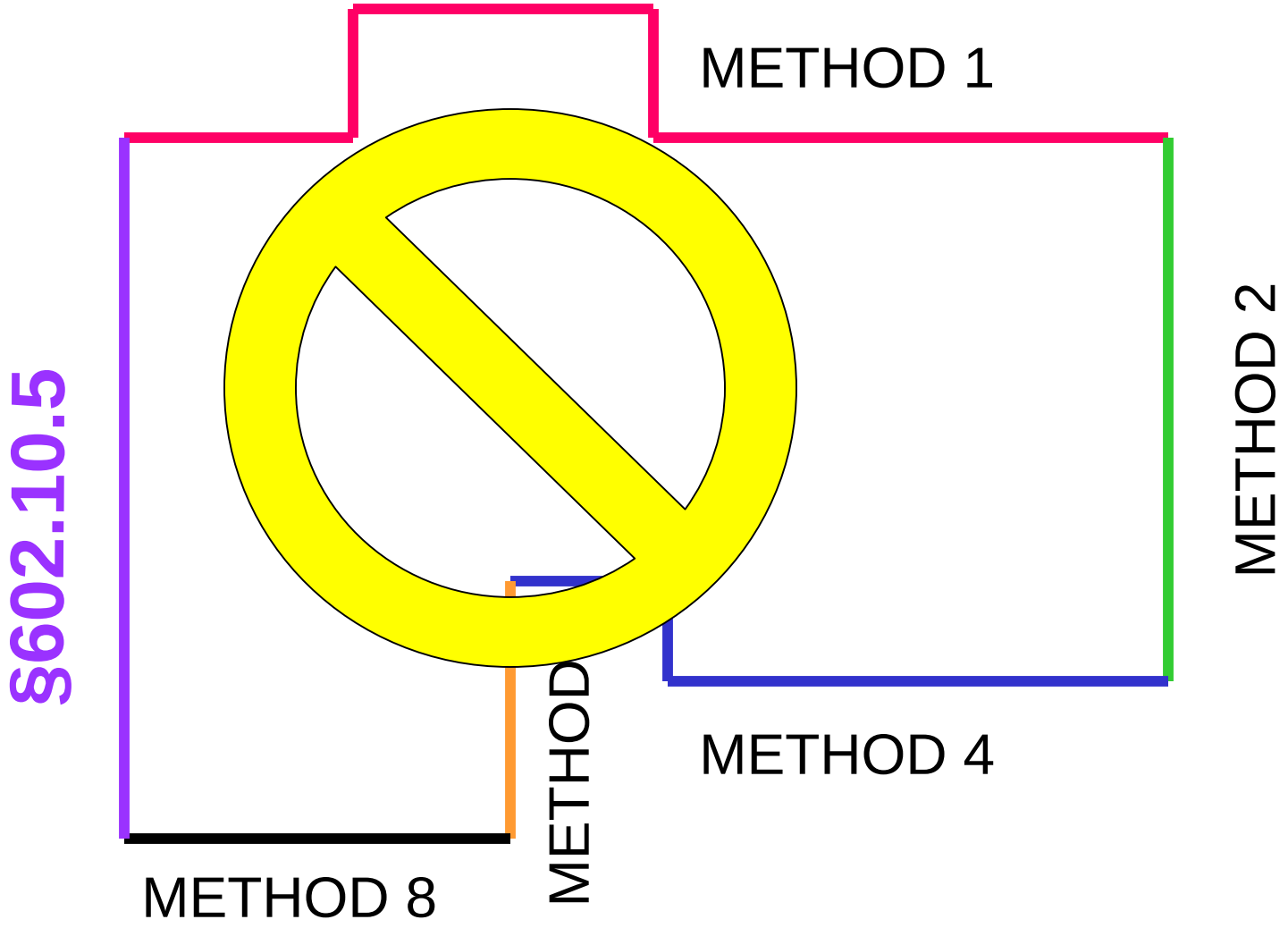
IRC §602.10.5

CONTINUOUS OSB (WHOLE HOUSE)

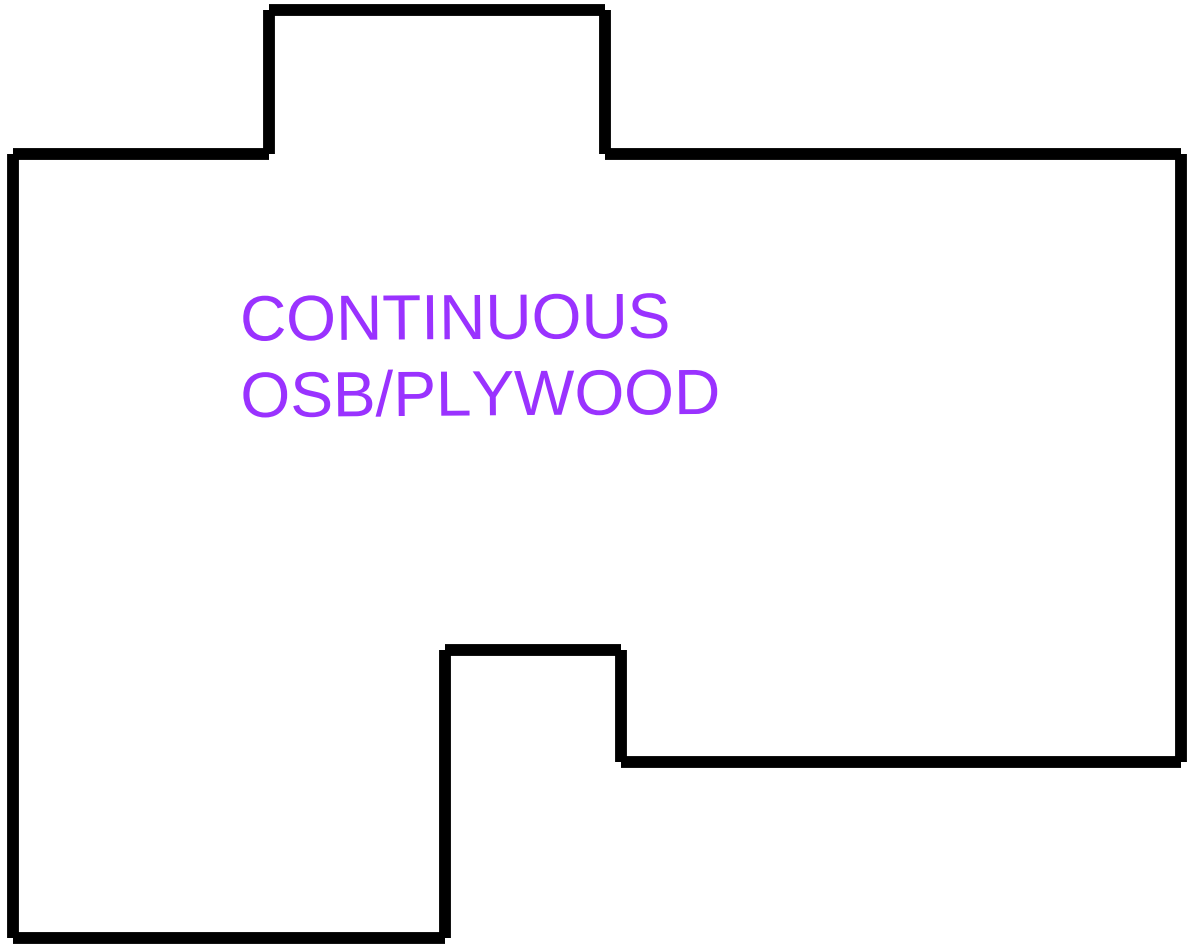
OPENING HEIGHT	8’ STUDS	9’ STUDS	10’STUDS
5’-0”	24”	27”	30”
6’-0”	28”	28”	30”
6’-8” DOOR	31”	31”	31”
7’-0”	35”	33”	33”
8’-0”	48”	39”	38”
9’-0”		54	47
10’-0”			60

CANNOT MIX AND MATCH METHODS 1-8 WITH

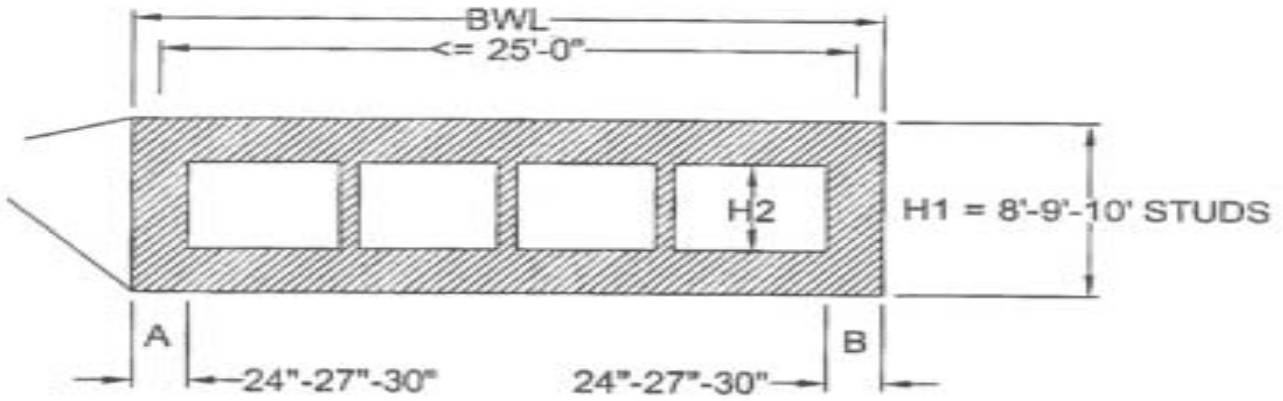
§602.10.5 *CONTINUOUS* OSB/PLYWOOD



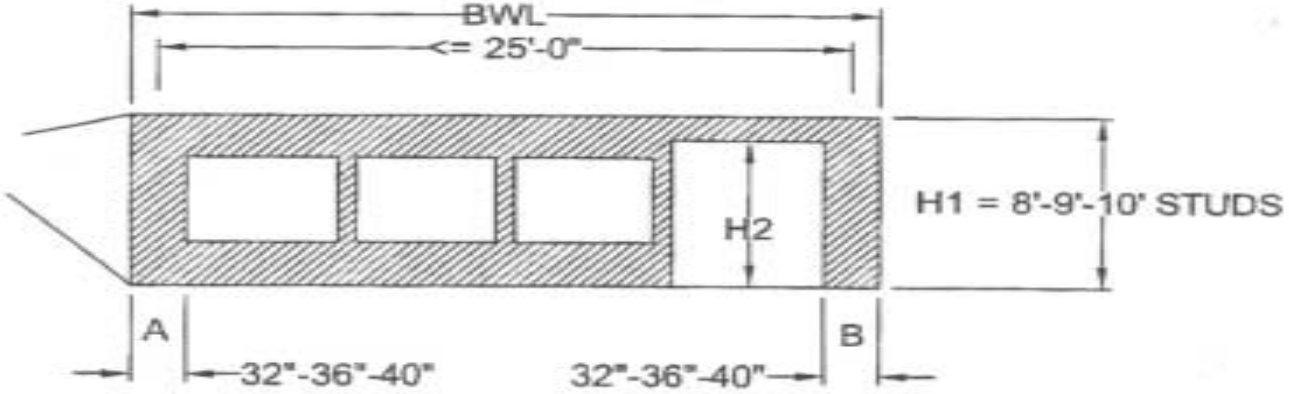
§602.10.5 MUST STAND ON ITS OWN

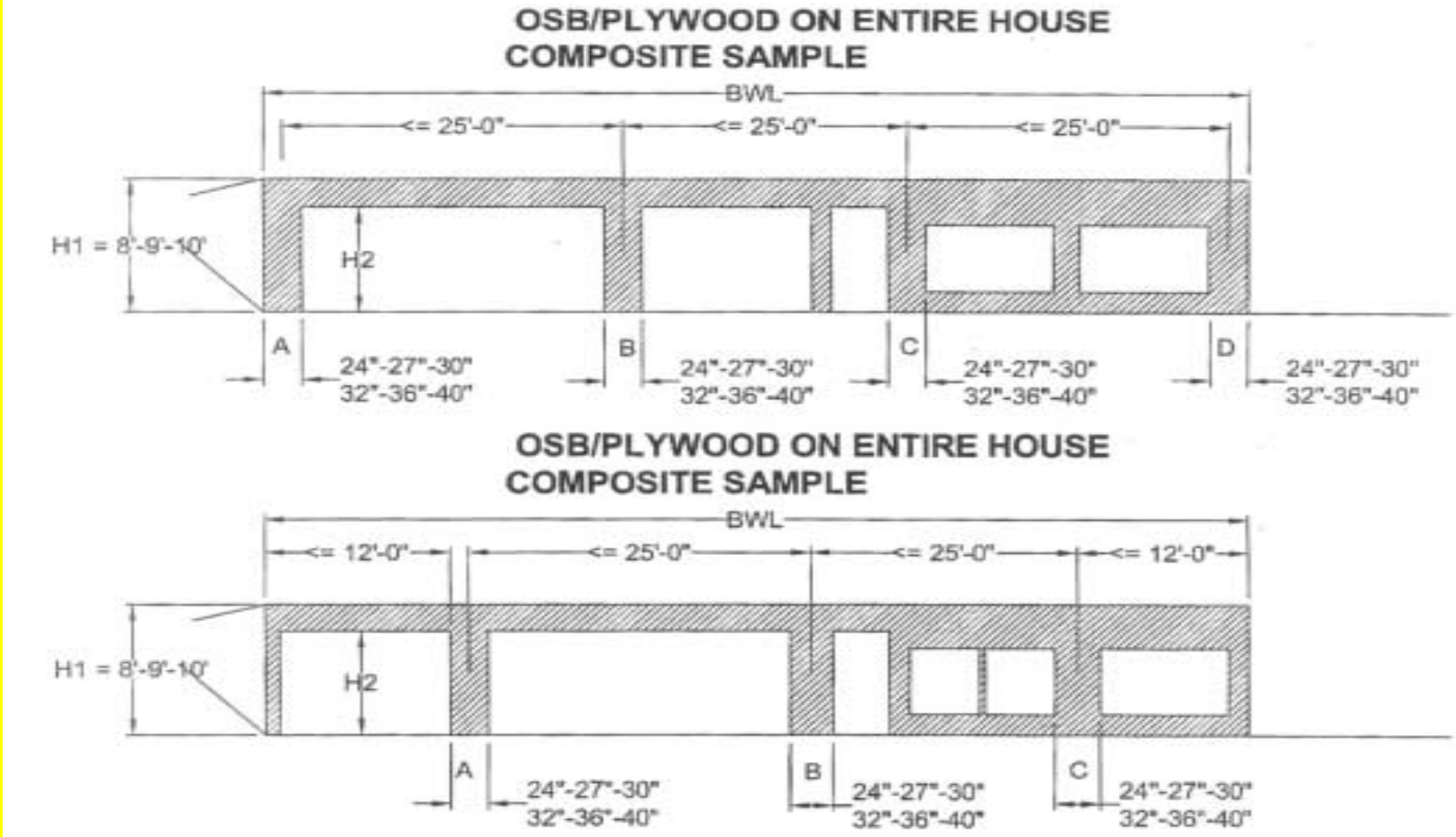


OSB/PLYWOOD ON ENTIRE HOUSE
BWP @ CORNERS



OSB/PLYWOOD ON ENTIRE HOUSE
BWP @ CORNERS

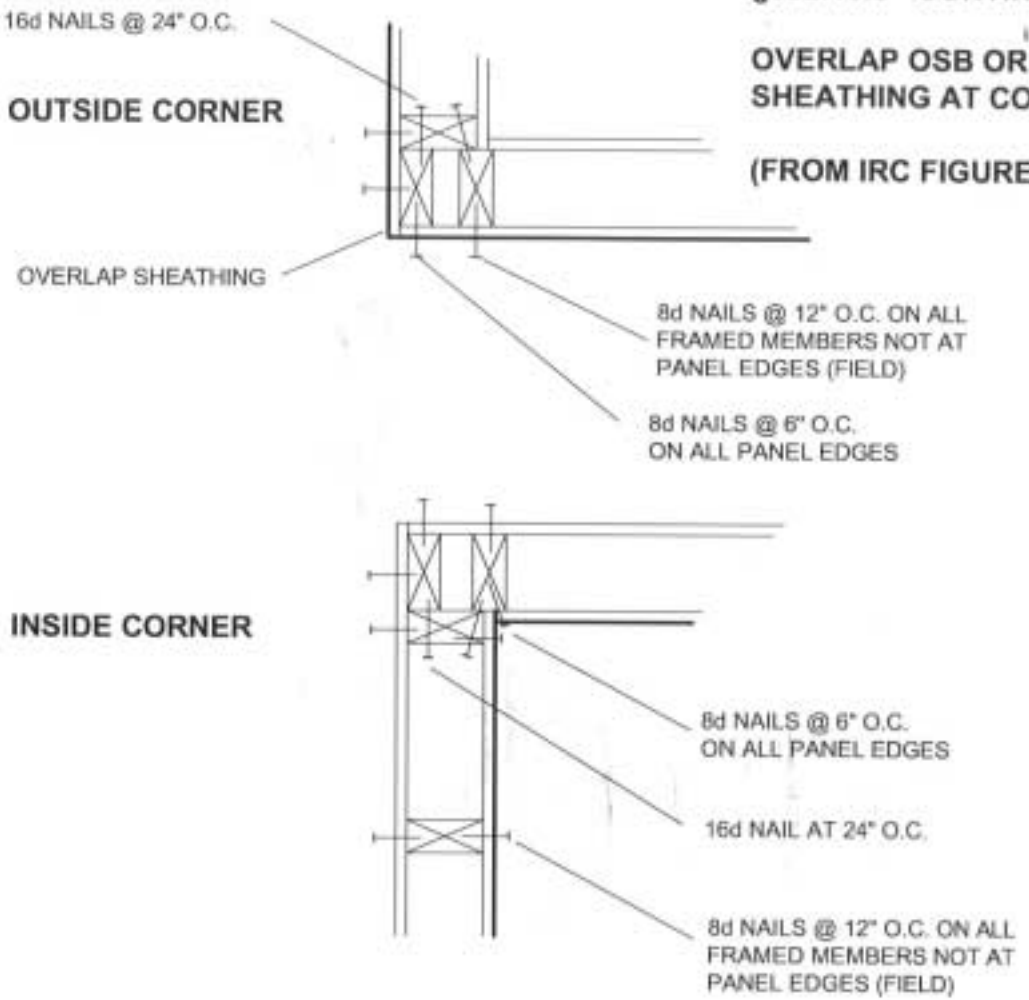



OSB/PLYWOOD ON ENTIRE HOUSE
COMPOSITE SAMPLE
BWL
<= 25'-0"
<= 25'-0"
<= 25'-0"
H1 = 8'-9'-10'
H2
A
24"-27"-30"
32"-36"-40"
B
24"-27"-30"
32"-36"-40"
C
24"-27"-30"
32"-36"-40"
D
24"-27"-30"
32"-36"-40"
OSB/PLYWOOD ON ENTIRE HOUSE
COMPOSITE SAMPLE
BWL
<= 12'-0"
<= 25'-0"
<= 25'-0"
<= 12'-0"
H1 = 8'-9'-10'
H2
A
24"-27"-30"
32"-36"-40"
B
24"-27"-30"
32"-36"-40"
C
24"-27"-30"
32"-36"-40"

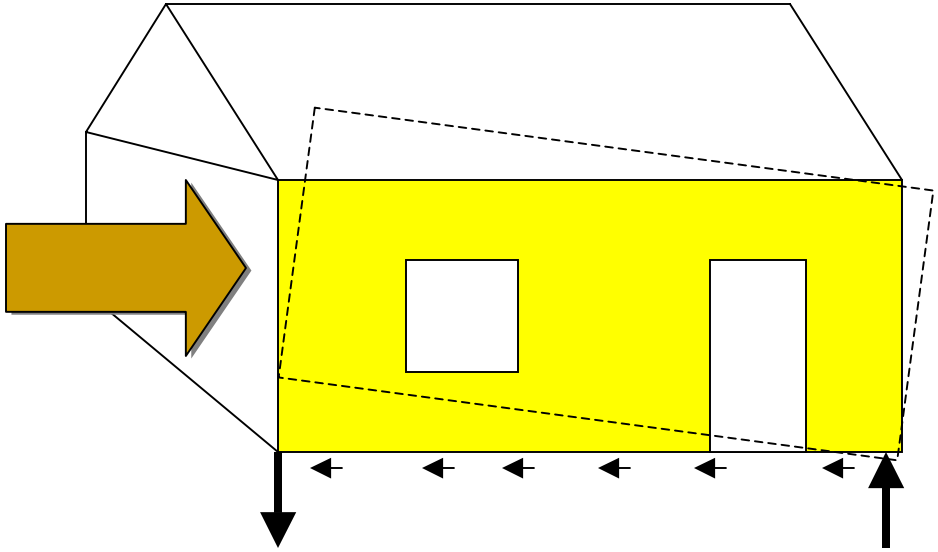
§602.10.5 - CONTINUOUS OSB

OVERLAP OSB OR PLYWOOD SHEATHING AT CORNERS

(FROM IRC FIGURE 602.10.5)



BRACED WALL PANELS USING CONTINUOUS OSB



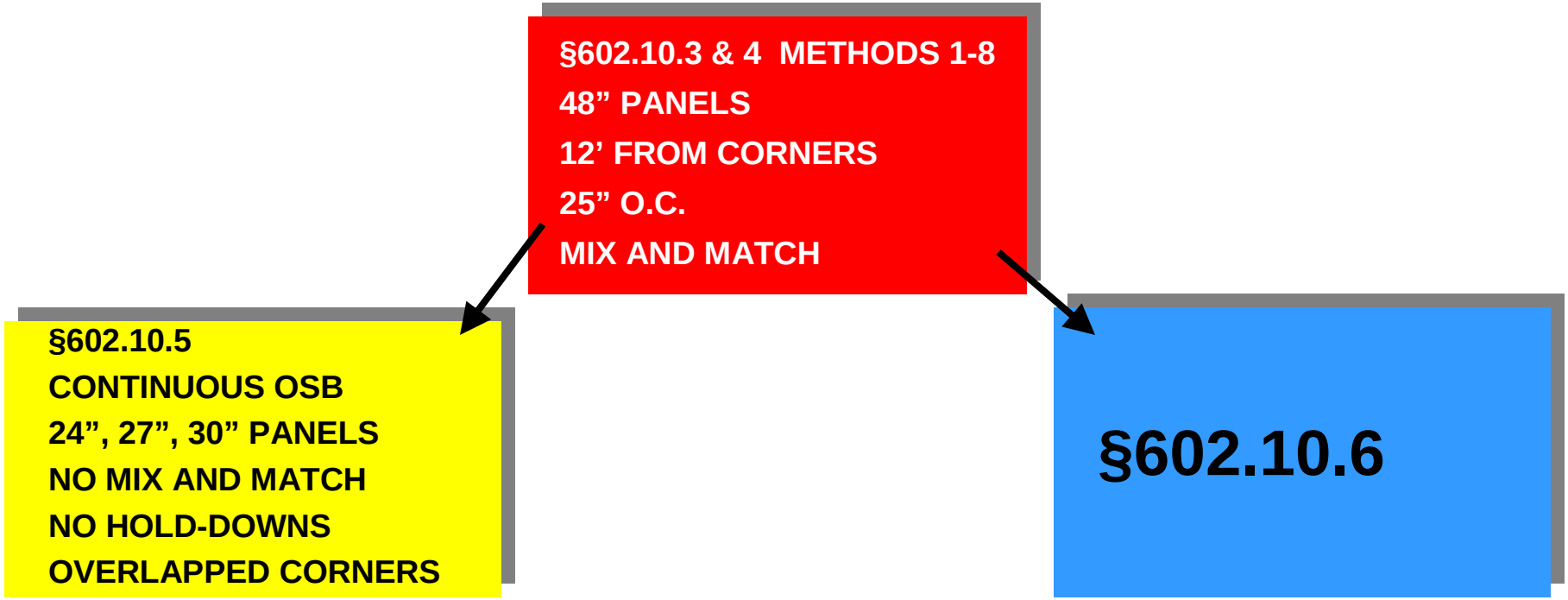
EQUIVALENT TO PERFORATED SHEAR WALLS

§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

AND WHAT IF THAT IS TOO EXPENSIVE?



CONSIDER ANOTHER ALTERNATIVE

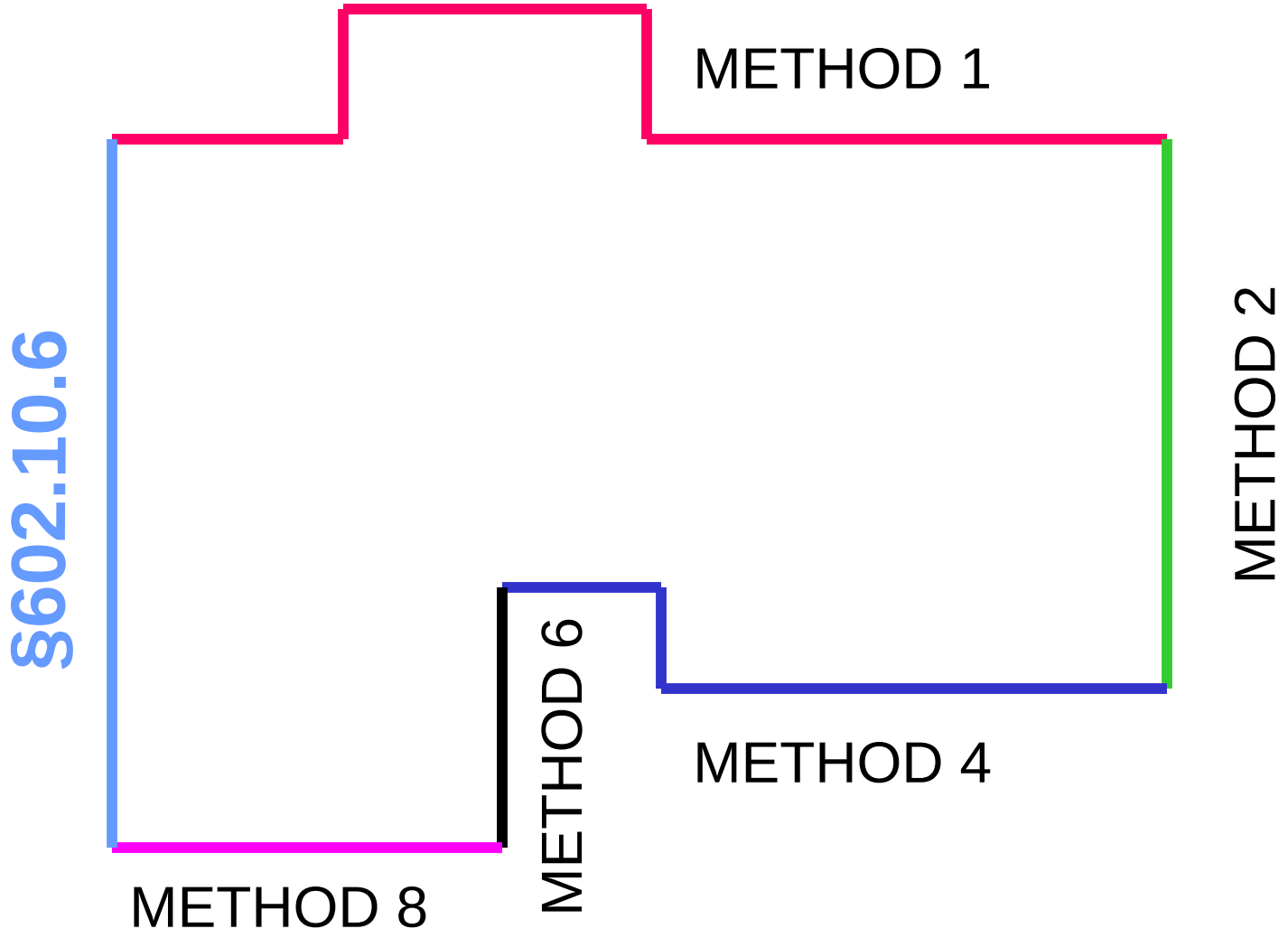
§602.10.6 ALTERNATIVE METHOD

REPLACES ANY METHOD 1-8, 48” PANEL

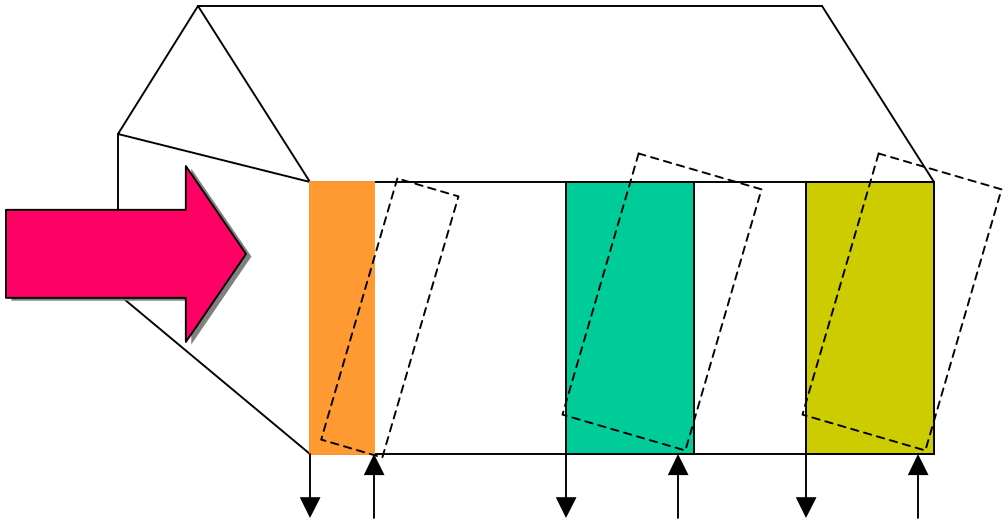
REQUIRES:

- 32” OSB PANEL
- MAX 10’ STUDS
- SPECIAL NAILING AND BLOCKING
- SPECIAL A.B. BOLTS & HOLD-DOWNS
- SPECIAL FOOTINGS & REBAR

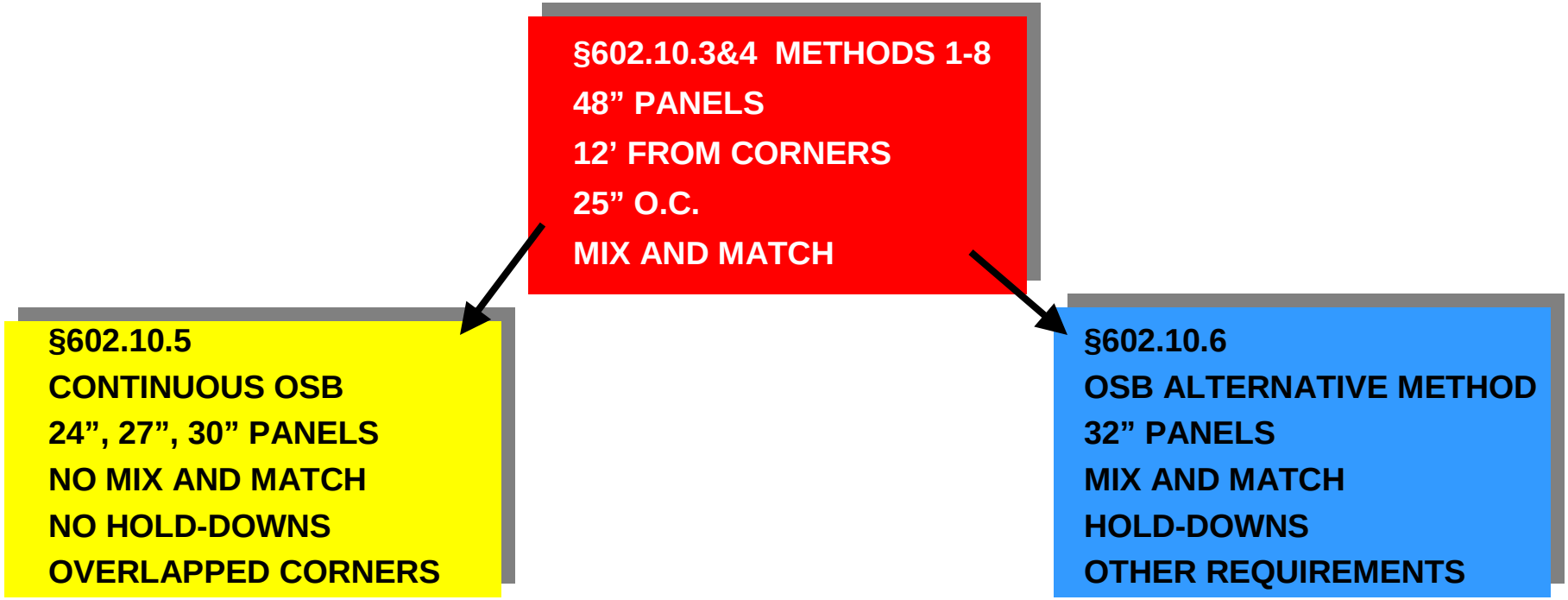
§602.10.6 – CAN REPLACE ANY 48” BWP



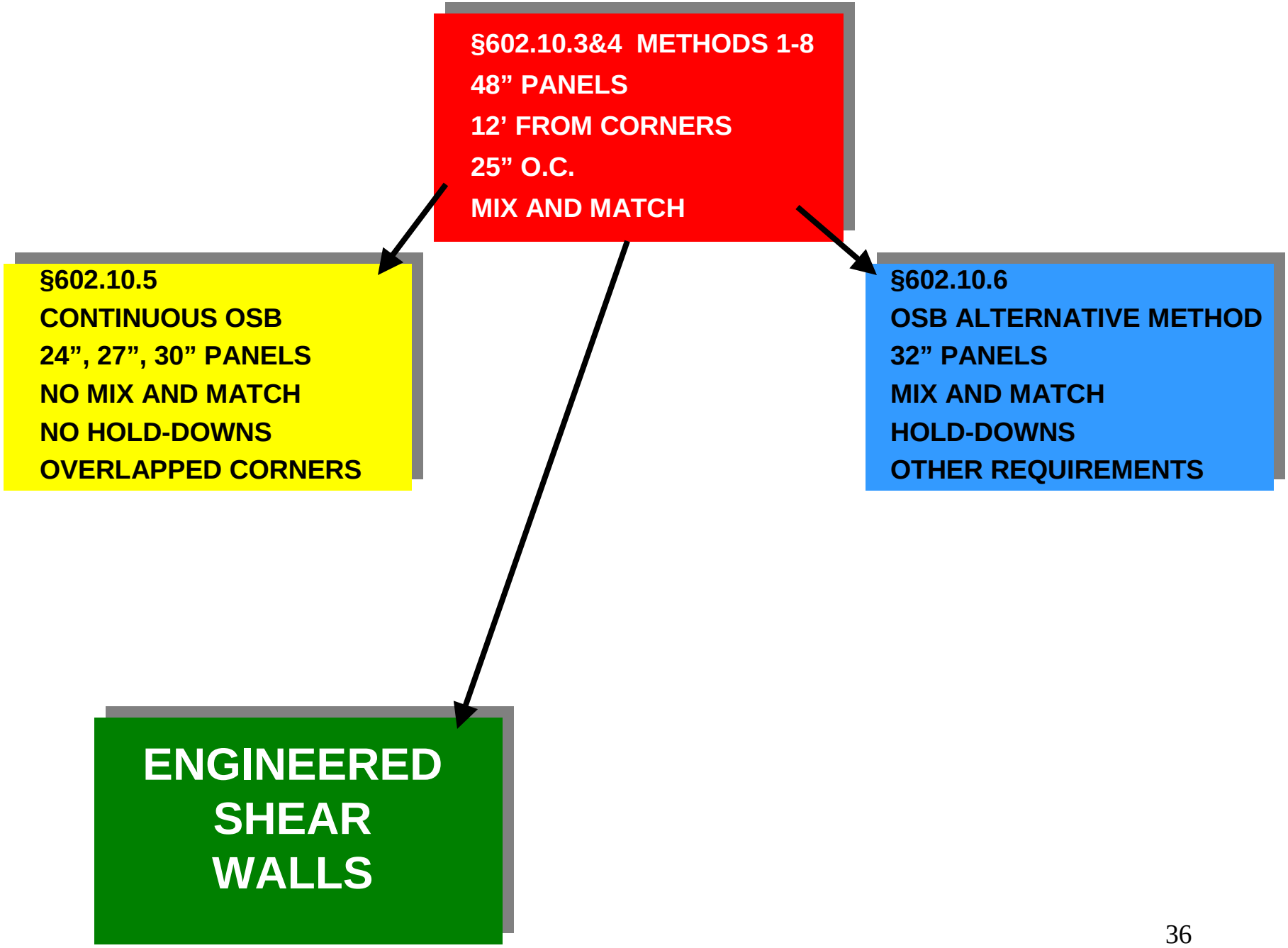
ALTERNATIVE METHOD



EQUIVALENT TO SEGMENTED SHEAR WALLS



AND WHAT IF THAT STILL DOESN’T HELP??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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

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

§602.10.3&4 METHODS 1-8
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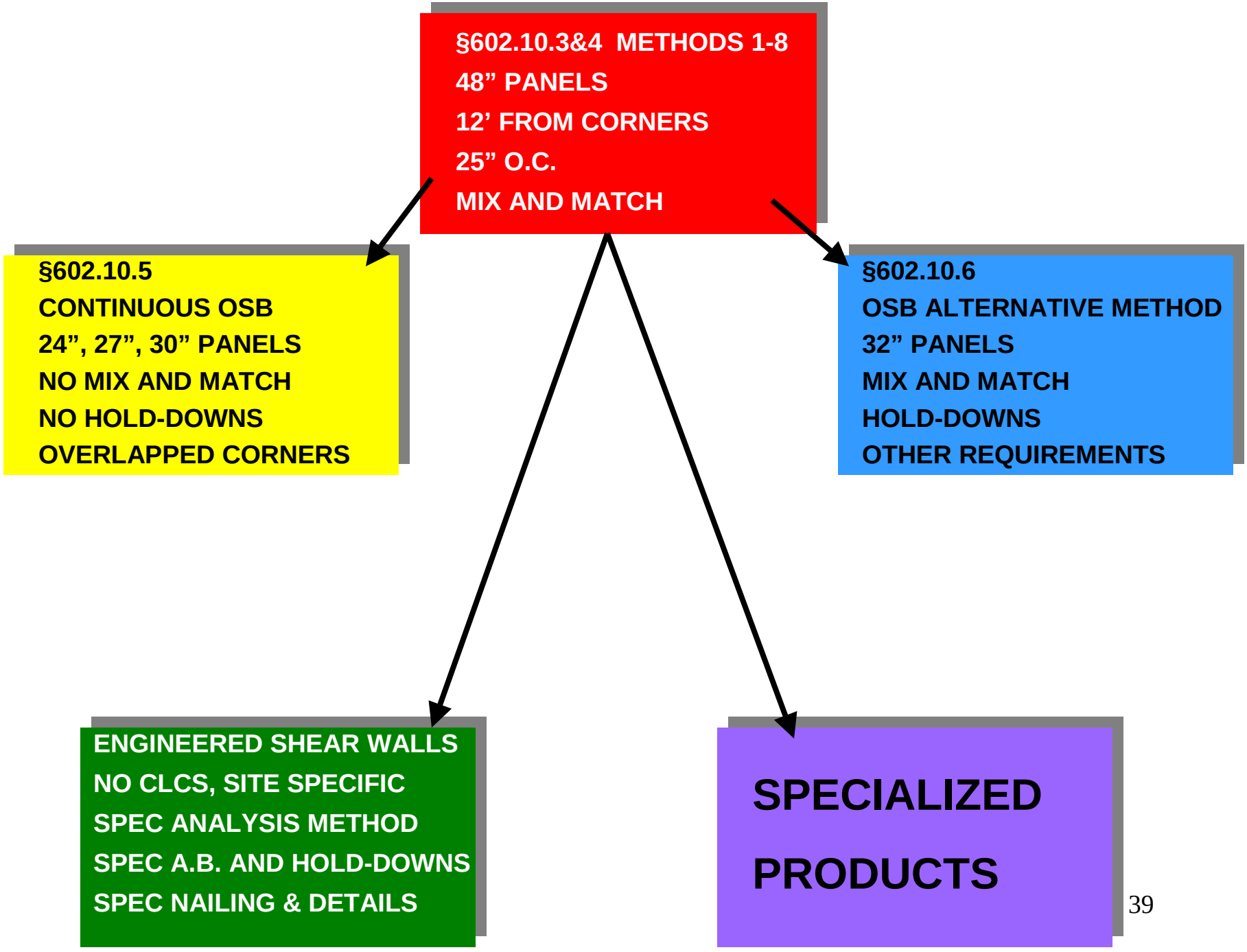
OSB ALTERNATIVE METHOD
32” PANELS
MIX AND MATCH
HOLD-DOWNS
OTHER REQUIREMENTS

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

THAT’S ALSO EXPENSIVE.

ARE THERE ANY OTHER CHOICES?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ENGINEERED SHEAR WALLS
NO CLCS, SITE SPECIFIC
SPEC ANALYSIS METHOD
SPEC A.B. AND HOLD-DOWNS
SPEC NAILING & DETAILS
SPECIALIZED
PRODUCTS

ENGINEERED PRODUCTS

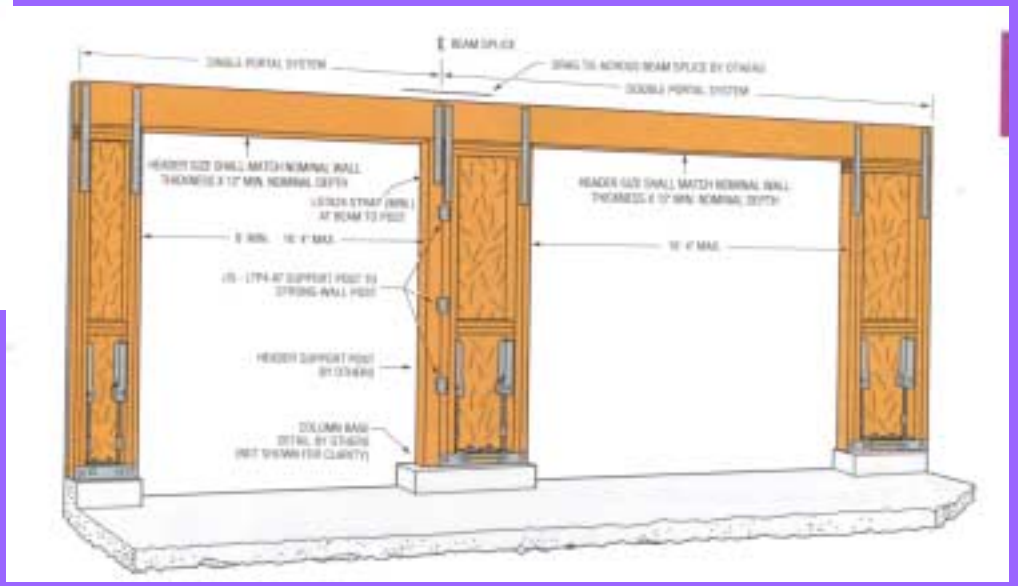
TESTED PRODUCTS:

- SIMPSON STRONG WALL
- HARDY FRAME SHEAR WALL
- SIMPSON LET-IN BRACING
- OTHERS

SIMPSON STRONG WALL

Standard Strong-Wall® Shearwall

U.S. Patents 5,706,626; 6,098,467, 6,109,850, and 6,327,831



HARDY WALL

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48” PANELS
12’ FROM CORNERS
25” O.C.
MIX AND MATCH

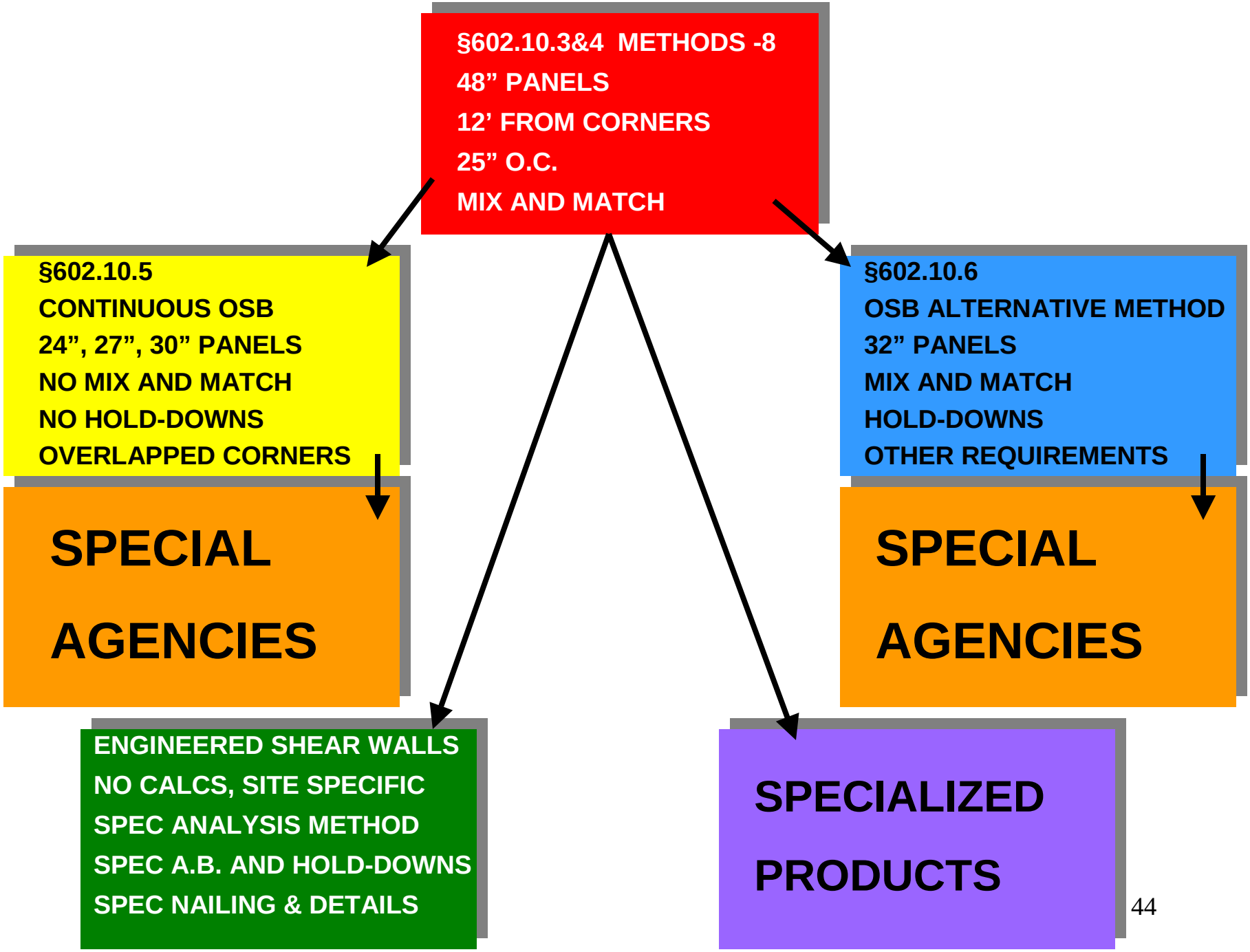
§602.10.5
CONTINUOUS OSB
24”, 27”, 30” PANELS
NO MIX AND MATCH
NO HOLD-DOWNS
OVERLAPPED CORNERS

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

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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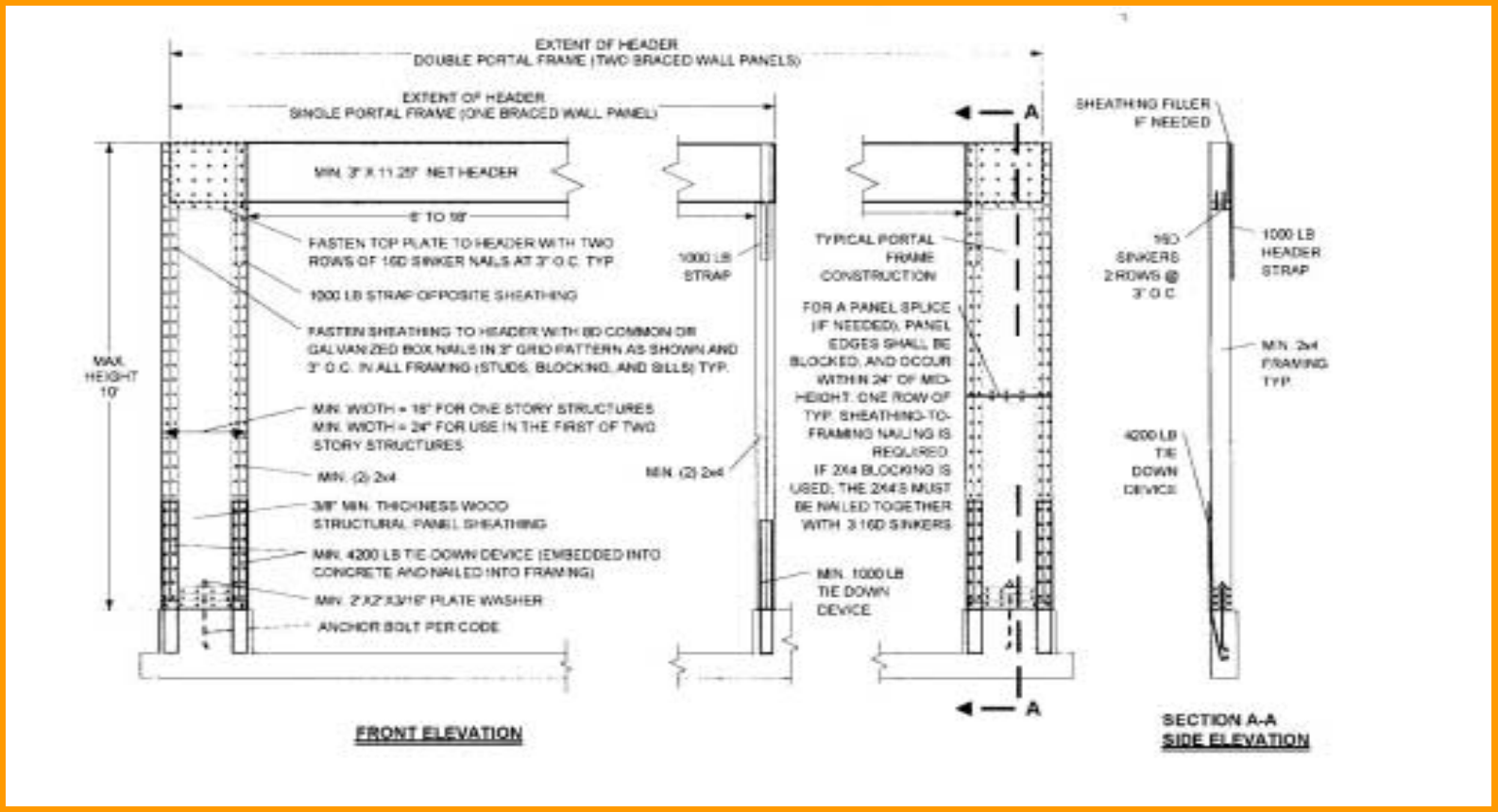
SPEC A.B. AND HOLD-DOWNS
SPEC NAILING & DETAILS
SPECIALIZED PRODUCTS

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



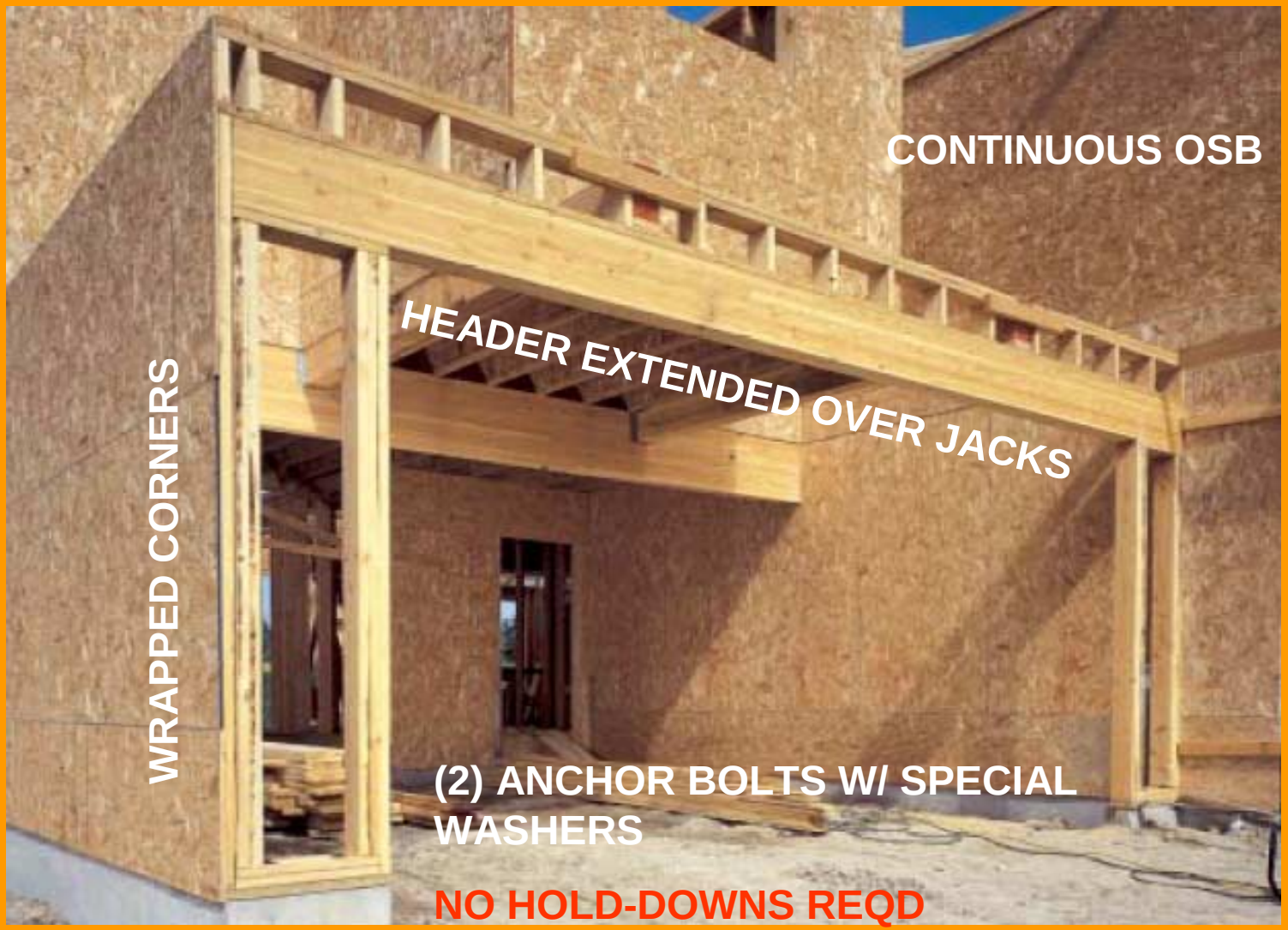
TT-073A USE ANY PLACE ON HOUSE WITH ANY METHOD 1- 8 REQUIRES HOLD-DOWNS + A.B.

TESTING AGENCY DESIGNS

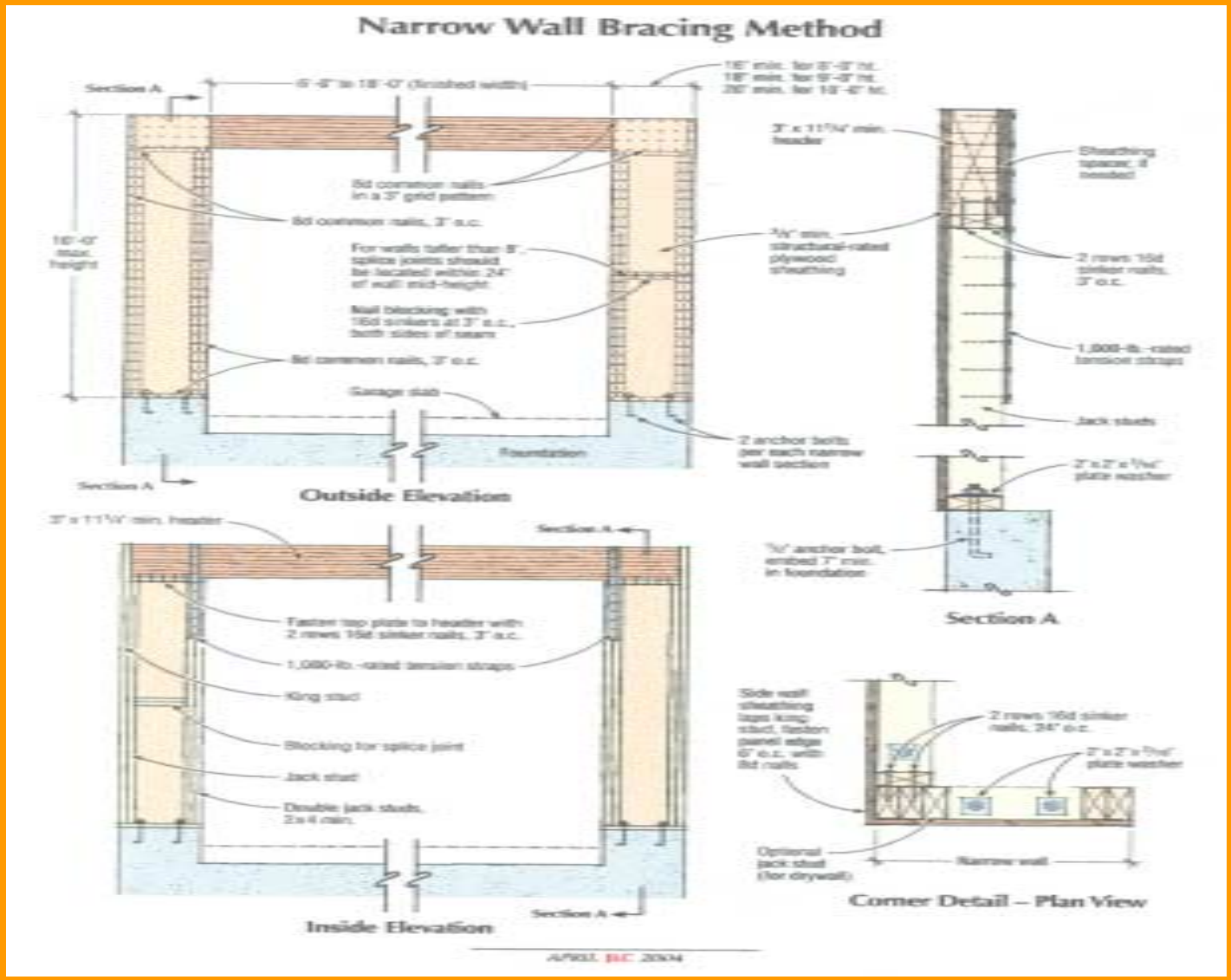
AMERICAN PLYWOOD ASSOCIATION

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

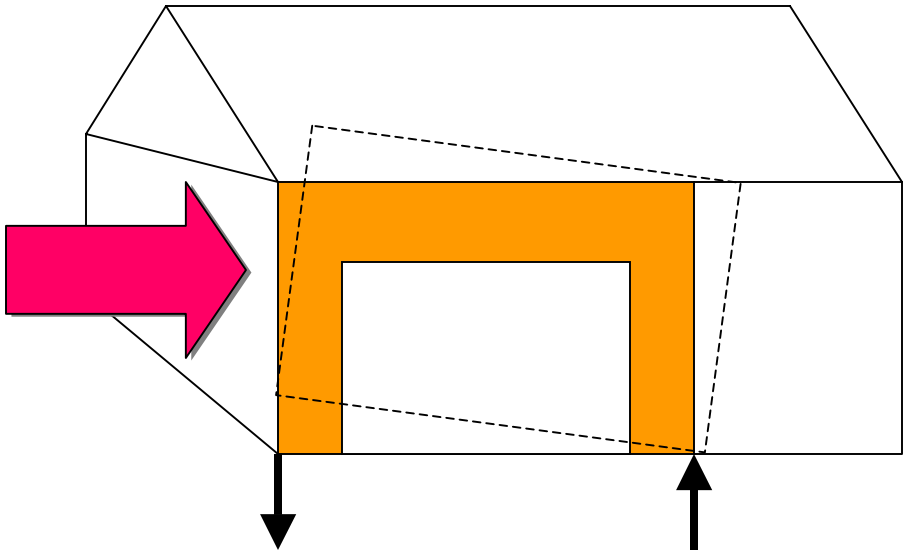


APA 077A FOR GARAGES W/ CONT OSB

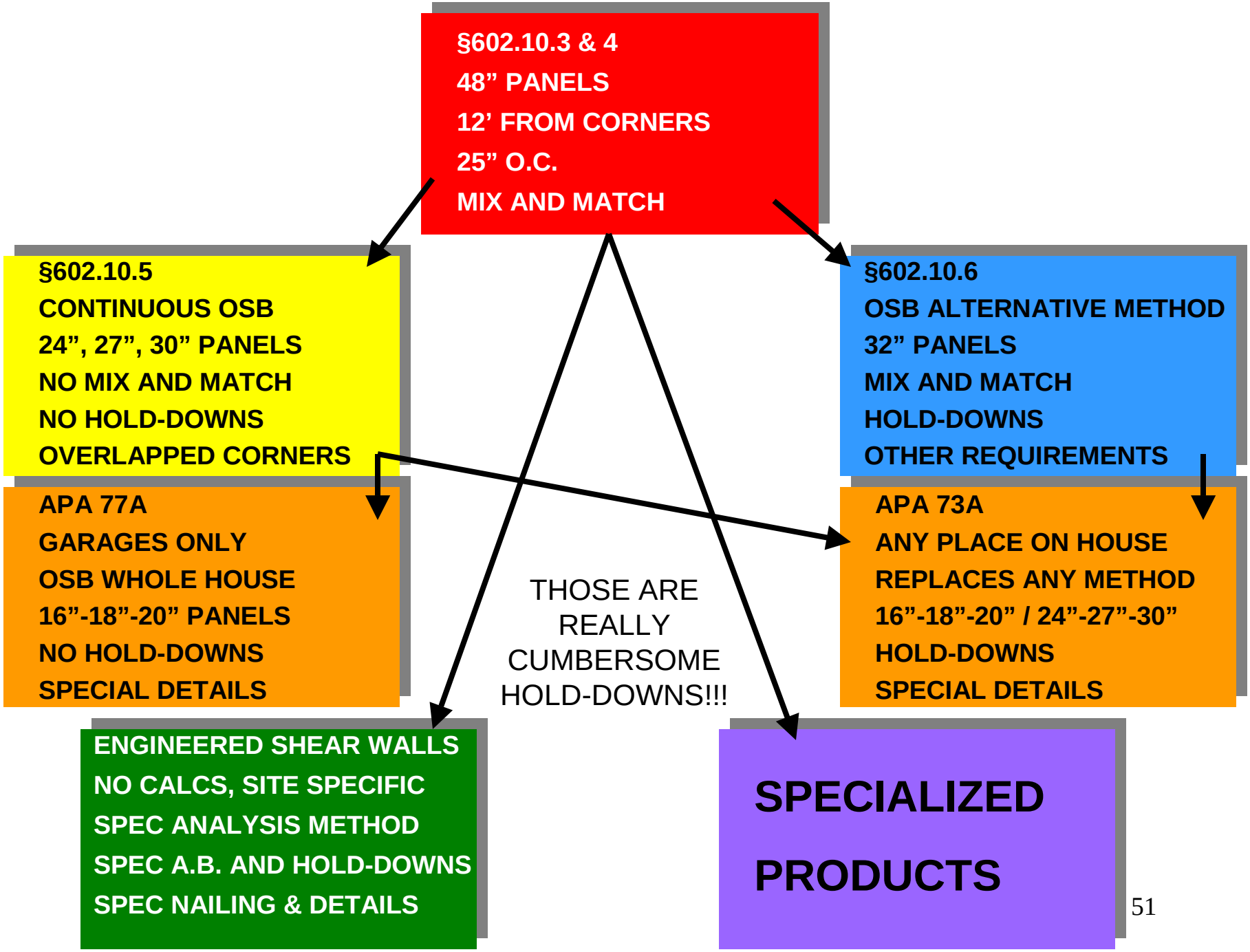


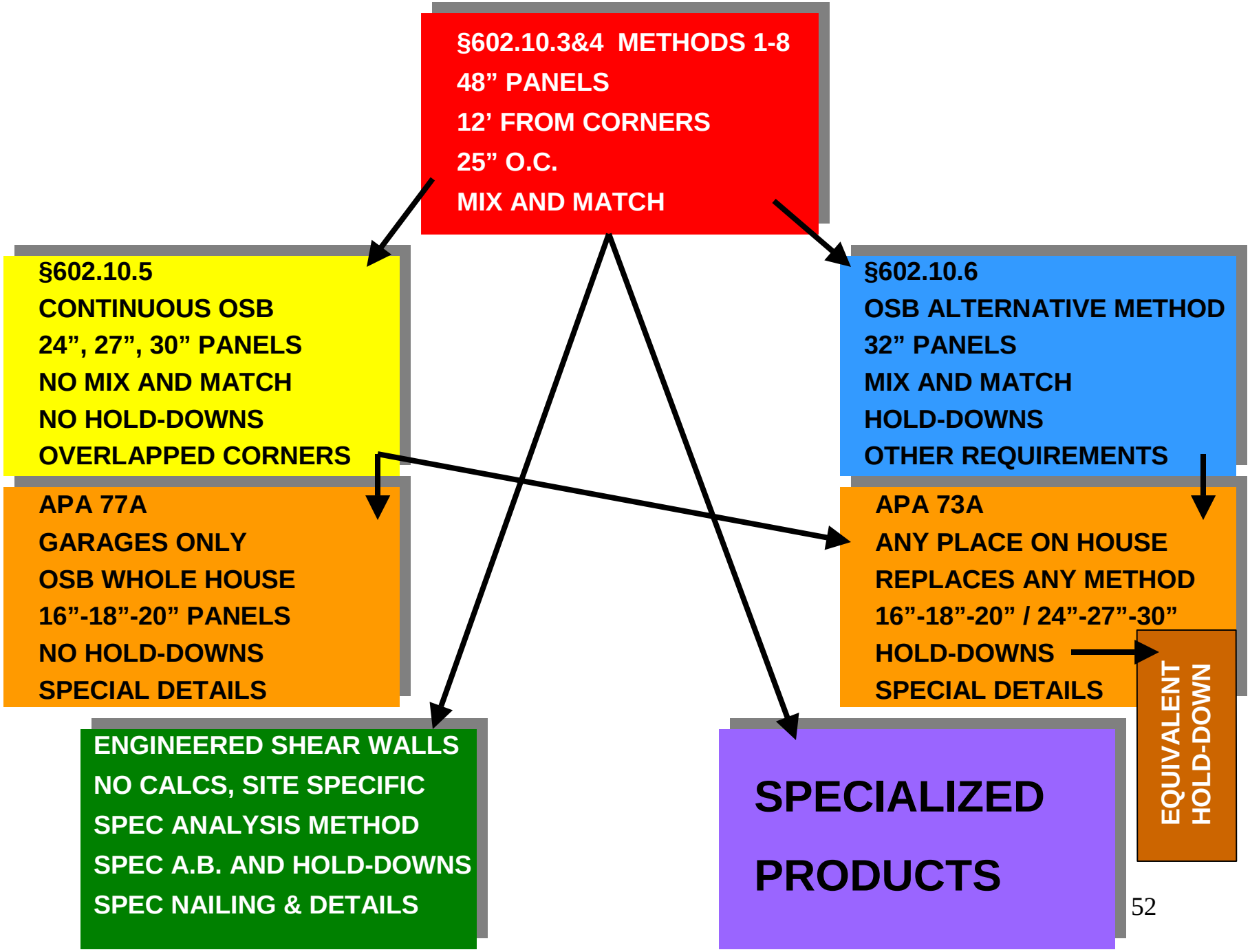
APA 077A FOR GARAGES W/ CONT OSB

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
THOSE ARE REALLY CUMBERSOME HOLD-DOWNS!!!
ENGINEERED SHEAR WALLS
NO CALCS, SITE SPECIFIC
SPEC ANALYSIS METHOD
SPEC A.B. AND HOLD-DOWNS
SPEC NAILING & DETAILS
SPECIALIZED PRODUCTS


§602.10.3&4 METHODS 1-8
48" PANELS
12' FROM CORNERS
25" O.C.
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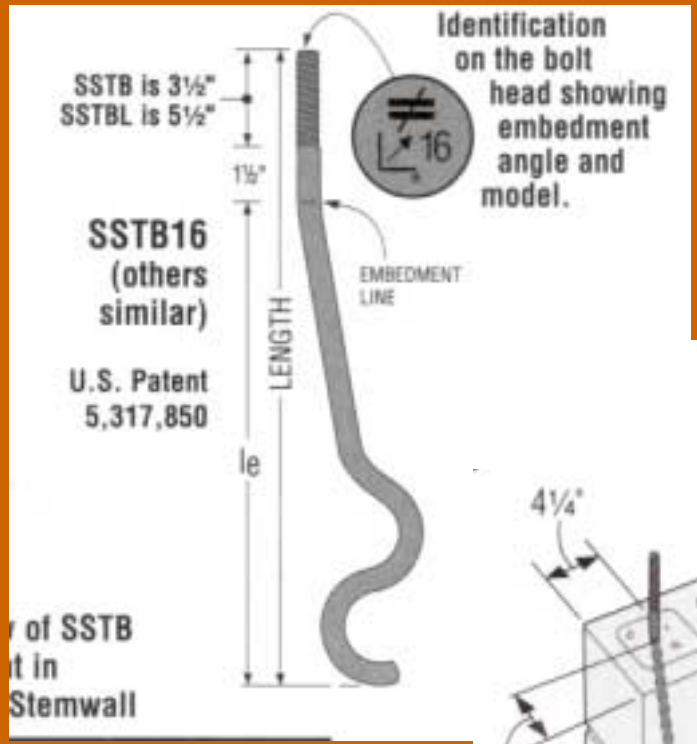
16"-18"-20" / 24"-27"-30"
HOLD-DOWNS
SPECIAL DETAILS
EQUIVALENT HOLD-DOWN
ENGINEERED SHEAR WALLS
NO CALCS, SITE SPECIFIC
SPEC ANALYSIS METHOD
SPEC A.B. AND HOLD-DOWNS
SPEC NAILING & DETAILS
SPECIALIZED PRODUCTS

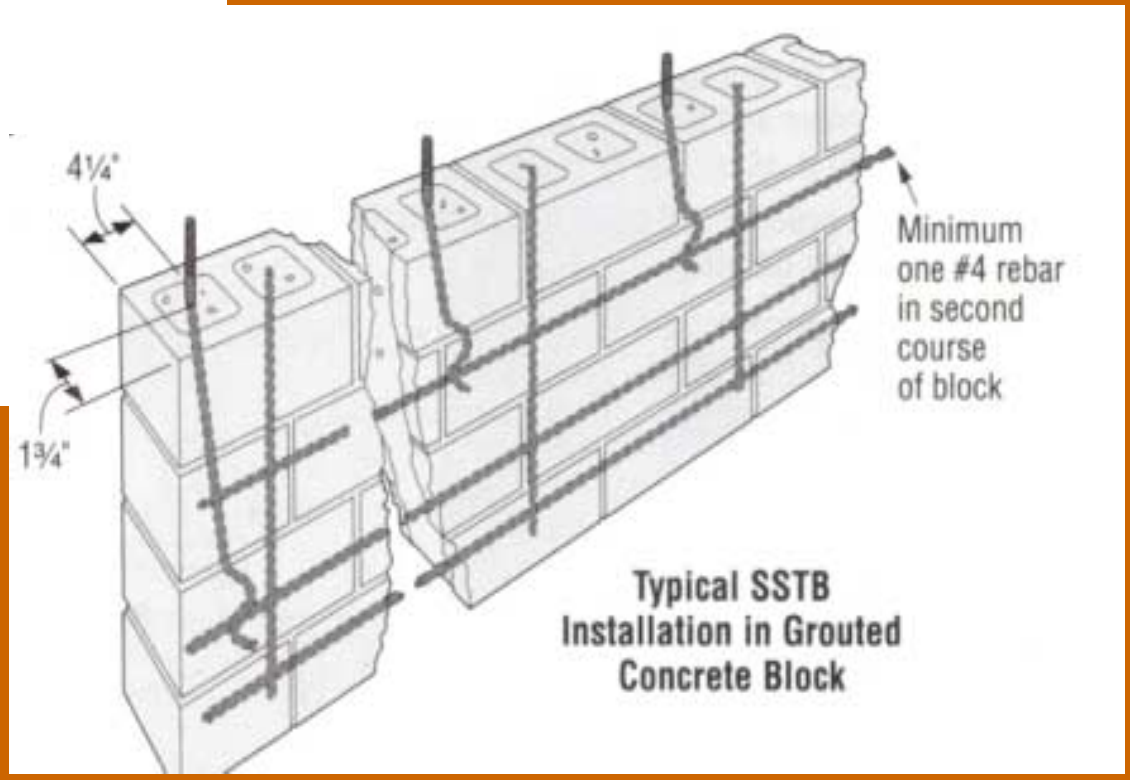
EQUIVALENT HOLD-DOWN

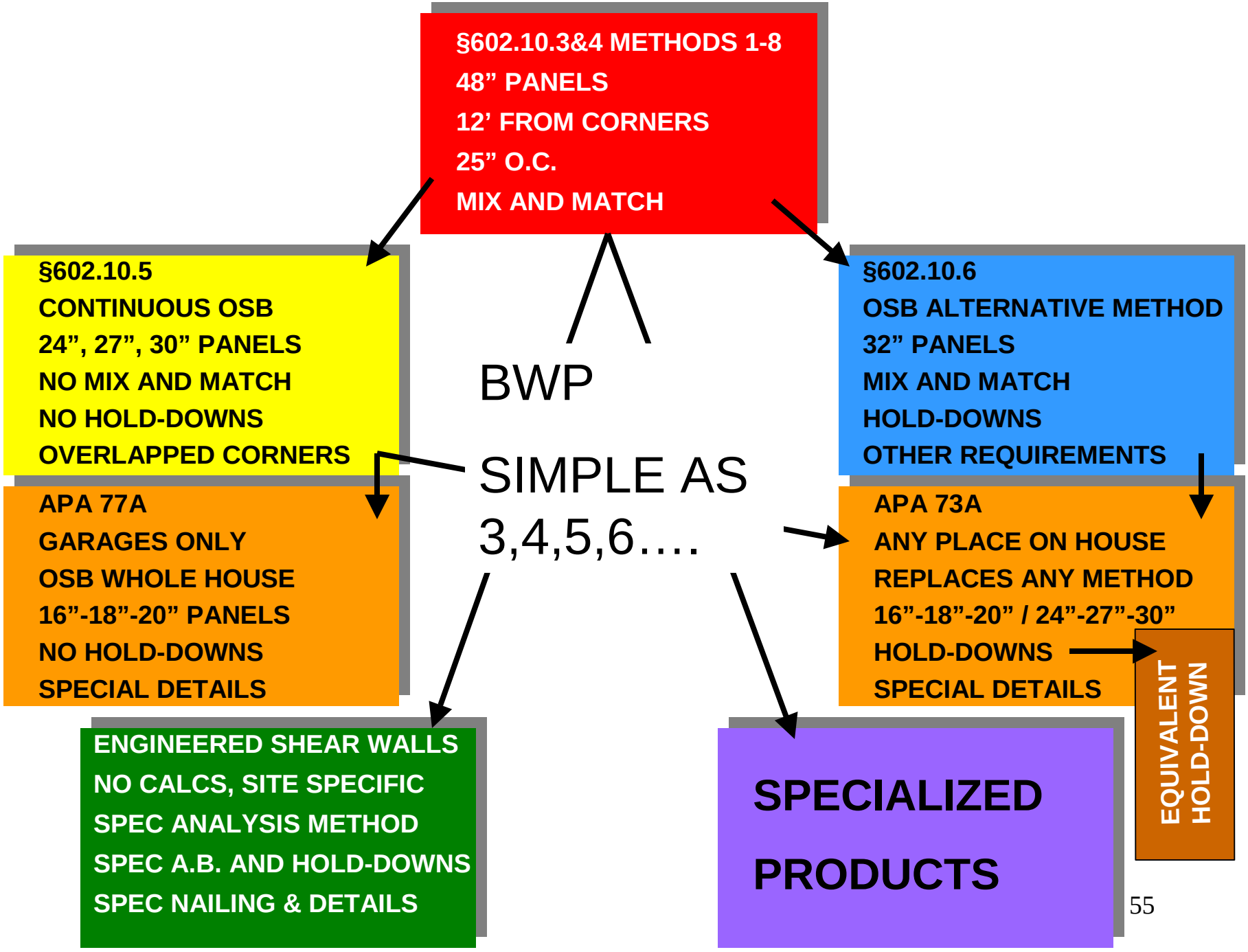
TT-073 PORTAL FRAME BRACING

- 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


Identification on the bolt head showing embedment angle and model.
SSTB is 3½"
SSTBL is 5½"
1½"
SSTB16
(others similar)
U.S. Patent 5,317,850
LENGTH
le
EMBEDMENT LINE
16
of SSTB
t in
Stemwall


4¼"
1¾"
Minimum one #4 rebar in second course of block
Typical SSTB Installation in Grouted Concrete Block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12' FROM CORNERS
25" O.C.
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§602.10.6
OSB ALTERNATIVE METHOD
32" PANELS
MIX AND MATCH
HOLD-DOWNS
OTHER REQUIREMENTS
BWP
SIMPLE AS
3,4,5,6….
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"
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EQUIVALENT HOLD-DOWN
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SPEC ANALYSIS METHOD
SPEC A.B. AND HOLD-DOWNS
SPEC NAILING & DETAILS
SPECIALIZED
PRODUCTS

METHOD	MIN BWP WIDTH ALLOWED	MIX & MATCH	HOLD-DOWN
2,3,4,5,6,7,8	48”	YES	NO
602.10.5 CONT OSB W/ OVERLAP CORNERS	24”-27”-30” 32”-36”-40”	NO	NO
602.10.6 ALTERNATE	32”	YES	1800#
ENGINEERED	ENGR	ENGR	ENGR
SPEC PRODUCT	MFGR	MFGR	MFGR
APA TT-073A (OR EQUIVALENT) ANYWHERE	16”-18”-20” (1 STORY) 24”-27”-30” (1ST OF 2 STORY)	YES	4200#
APA TT-077A GARAGES	16”-18”-20”	NO - OSB ONLY	NO

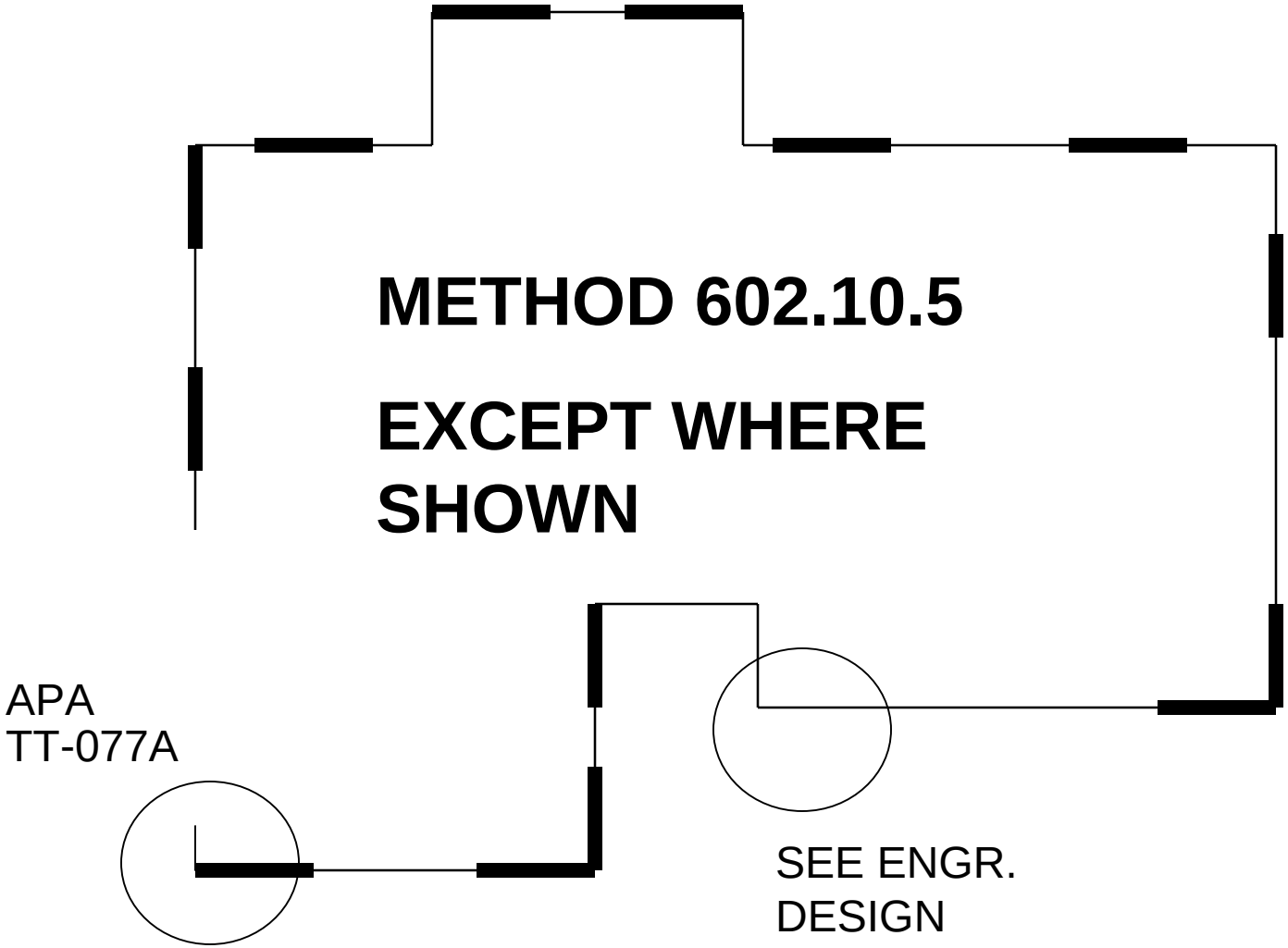
SPECIAL SITUATIONS

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