TOTAL SHELL STRUCTURE c8

SUMMARY SHELL CHAPTERS C8+C9
***c8 STUCTURE**_THIS CHAPTER DEALS WITH GRAVITY LOADING AND WIND LOADING CONSIDERING THE BIGGER PICTURE OF THE BEHAVIOR OF AND REQUIIREMENTS FOR THE WHOLE BUILDING SHELL.
***c9 THERMAL ENVELOPE**_SIMILARLY CHAPTER 9 ADDRESSES THE ENTIRE BUILDING SHELL THERMAL ENVELOPE.

CODE REFERENCES
***THIS CHAPTER**_REFERENCES THE IRC CODE AND INCLUDES CODE TABLES WITH SOME COMMENT AND INTERPRETATION. THERE IS A LOT OF USEFUL CONTENT AND A LOT OF ANSWERS IN THE CODE, A FAIR AMOUNT OF WHICH TAKES PATIENCE TO FIND AND INTERPRET. WIND DESIGN CONSUMES MUCH OF THE CHAPTER. WIND LOADING AND PRESCRIPTIVE DESIGN FOR WIND LOADS IS INHERENTLY COMPLICATED.EFFORTS HAVE BEEN MADE IN THE CODE TO SIMPLIFY THE ENGINERING SIDE OF THIS AND OFFER UNDERSTANDIBLE PRESCRIPTIVE SOLUTIONS. THIS CHAPTER WILL DO ITS BEST TO EXPLAIN THE WHY ANDHOW OF IT. IF ONE IS NOT DETAIL ORIENTED THEN READING THE OVERVIEW SUMMARY c8.4 MAY BE SMART AND FORGET THE REST.
***THE IRC IS A LIMITED WIND DEFENSE TOOL**_PUBLIC/COMMERCIAL BUILDINGS GET A BIT MORE WIND SCRUTINY. AND PROFESSIONAL STRUCTURAL ENGINEERS ARE INVOLVED IN THESE PROJECTS. THE GO TO RESOURCE REGARDING WIND ANALYSIS AND DESIGN IS THE **ASCE** (**A**MERICAN **S**OCIEETY OF **C**IVIL **E**NGINEERS), AND THEIR MANUAL ASCE 7 IS THE MORE REFERENCED AND AUTHORITATIVE RESOURCE, AND ONE THE COMMERCIAL CODE (THE **UBC**), AND THE RESIDENTIAL CODE (THE **IRC**) BOTH REFERENCE. THAT MANUAL'S CHAPTER 26 DEALS WITH WIND. THIS PROJECT WILL NOT BE REFERENCING THAT ASCE MANUAL OR ITS ENGINEERING EXCEPT FOR THE ONE FOLLOWING COMMENT SET.
***ASCE COMMENTS**_THERE ARE DIFFERENT ACCEPTED WAYS OF QUANTIFYING WIND SPEEDS FOR DESIGN PURPOSES. ASCE USES A DIFFERENT CLASSIFICATION FOR WIND SPEEDS THAN THE IRC IS CURRENTLY USING, FOR ITS OWN VALID REASONS. THE ASCE DISTINGUISHES THE **MWFRS** (**M**AIN **W**IND **F**ORCE **R**ESISTING **S**YSTEM) FROM THE **C+C** (COMPONENTS AND CLADDING). IN LAY TERMS THE **MWFRS** IS THE 'STRUCTURE', AND THE **C+C** REPRESENTS EVERYTHING WE ATTACH TO IT. THE IRC CODE DOES NOT REFERENCE **MWFRS** DESIGN, BUT DOES EMPLOY IT BEHIND THE SCENES FOR EXAMPLE WITH THE ROOF UPLIFT CALCULATIONS, AND IN DETERMINING LATERAL BRACING REQUIREMENTS. SO IT IS BEING EMPLOYED WHEN/WHERE NEEDED FOR THOSE 2 MOST IMPORTANT WIND BASED STRUCTURAL CONCERNS. THE IRC CODE DOES REFERENCE, AND REQUIRES THE USE OF **C+C** (COMPONENTS AND CLADDING) DESIGN PRESSURES AS A MEANS TO HELF SOLVE SOME DESIGN CONDITIONS THAT ARE NOTED THIS CHAPTER.

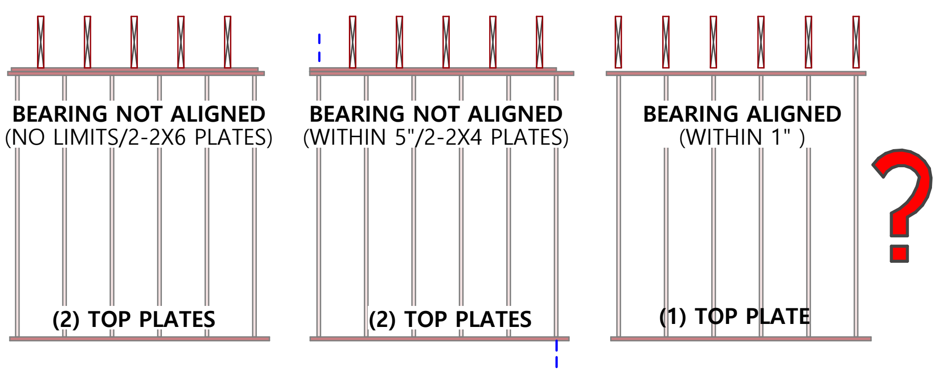
ADVANCED FRAMING SUMMARY

***LESS WOOD, MORE INSULATION**_SUMS UP THE PRIMARY THEME GOVERNING ADVANCED FRAMING. 'ADVANCED' IS A SLIGHTLY POMPOUS NAME FOR WHAT IS INVOLVED. IT REPRESENTS MOSTLY STANDARD CONSTRUCTION TECHNIQUES THAT PERMIT THE REDUCTION OF WOOD FRAMING MEMBERS WITHOUT SACRIFICING STRUCTURAL INTERGRITY. THIS, IN TURN, PERMITS MORE INSULATION AND LESS THERMAL BRIDGING IN THE WALLS. THERE IS A MEASURABLE EFFICIENCY GAINED.
***DESIGN ITEMS**_LUMBER SIZE SELECTIONS AND SPACING, SINGLE OR DBL TOP PLATE, HEADERS, AND JACK STUDS SUPPORTING THOSE HEADERS ARE STRUCTURAL ITEMS THAT NEED SOME PLANNING AND SPECIFYING ON PLANS. THESE STRUCTURAL CHOICES MAY, BUT DON'T NECESSARILY LEND THEMSELVES TO ADVANCED FRAMING PREFERENCES.
***STANDARD FRAMING ITEMS**_THREE STUD CORNERS, AND CRIPPLE STUDS, ARE EVERYDAY FRAMING DETAILS THAT DO NOT NEED PLANNING OR SPECIFYING. THESE ARE/SHOULD BE FRAMER HABITS.

CONVENTIONAL FRAMING		ADVANCED FRAMING
2x4 or 2x6 wood framing spaced 16 inches on center	?	2x6 wood framing spaced 24 inches on center
Double top plates	?	Single top plate
Three-stud corners	✓	Two-stud corners
Multiple jack studs	?	Minimal jack studs
Double or triple headers	?	Single headers
Multiple cripple studs	✓	Minimal cripple studs

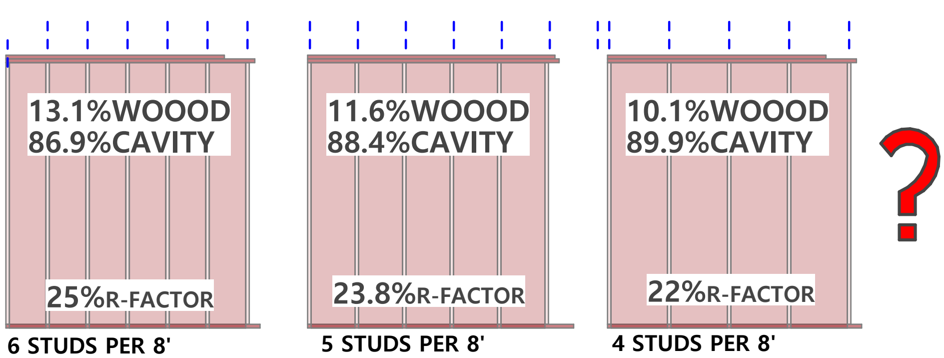
ADVANCED FRAMING RESOURCES

***LOOK/SEE FIRST**_BOTH RESOURCES BELOW HAVE CLEAR ILLUSTRATIONS THAT DEPICT THE ADVANCED FRAMING ITEMS. IF NOT FAMILIAR WITH THE TOPIC IT IS WORTH GETTING A VISUAL REFERENCE BEFORE EVALUATING APPLICABLE VALUE.
***APAWOOD.ORG DOCUMENT M400B**_IS A FREE DOWNLOAD (24 PAGES) THAT GRAPHICALLY EXPLAINS ADVANCED FRAMING. IT IS ILLUSTRATED IS SUCH A WAY ONE DOESN'T HAVE TO READ ANYTHING!
***BUILDING SCIENCE CORP DOCUMENT BSI-030**_FREE PRINTABLE DOWNLOAD IN BUILDING SCIENCE'S INSIGHT SERIES.



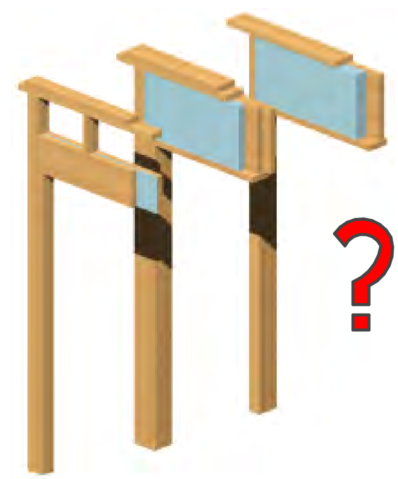
1 OR 2 TOP PLATES (c6.5)

***1 PLATE**_THE BIG LIMITATION IS I HAVING TO ALIGN BEARING FROM ROOF DOWN. IN 1 STORY HOMES, AND OR WHEN ONE DESIGNS FOR THAT ALIGNMENT, IT IS POSSIBLE AND WORTHWHILE.
***2 PLATES**_IS FAR MORE FORGIVING STRUCTURALLY. MULTIPLE STORY HOMES, OR ONES WITH ANY COMPLEXITY, USUALLY DEFY THE SINGLE TOP PLATE VIABILITY, MOSTLY BECAUSE OF THE ALIGNMENT ISSUE.



WOOD/INSULATION

***THIS WALL COMPARISON**_IS A VERY COMMON ONE POINTING OUT THE PREDICTABLE THERMAL EFFICIENCY WHEN INCREASING FRAMING CENTERS.



THE BETTER HEADER

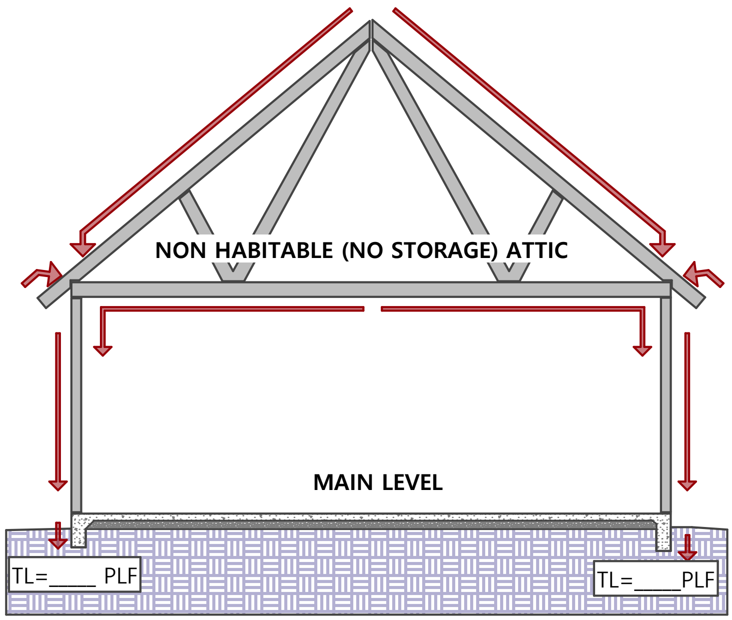
***1 HEADER/1 JACK/1 KING**_AND RIGID INSULATION FILLING OUT THE CAVITY.
***LIMITS**_HEADER, JACK AND KING STRUCTURAL REQUIREMENTS DON'T ALWAYS COOPERATE.
***BUT**_SOME INSULATION AT THE HEADER IS ALMOST ALWAYS POSSIBLE AND ADVISABLE ON EXTERIOR WALLS

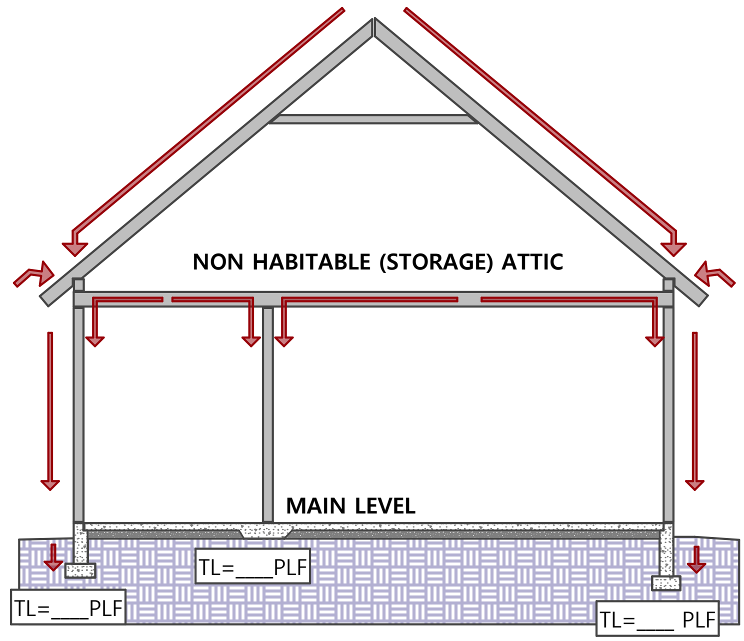
GRAVITY LOAD ADDITION

***THESE PROFILES_**REPRESENT 2D GRAPHIC TOOLS ASSISTING ONE IN THE MATH INVOLVED IN DETERMINING ACTUAL GRAVITY LOADS FOR FOOTING DETERMINATION. EXAMPLES OF THIS METHOD ARE REFERENCED SEVERAL PLACES (c5.11, **c5.12**, c6.7). CHAPTER 2 DISCUSSES FOOTING OPTIONS FAIRLY COMPLETELY. DOING THE REAL LOADING MATH WILL ENABLE ONE TO DETERMINE REAL FOOTING SIZES.

***CODE CHART_**NEXT PAGE SHOWS ALLOWANCES BASED ON BUILDING FORMAT AND LIVE ROOF LOAD. THESE PRESCRIPTIVE FOOTING SIZES NECESSARILY- AS WITH ALL PRESCRIPTIVE CHARTS- MAKE ASSUMPTIONS WHICH ARE USUALY EXPAINED IN THE CHART'S FOOTNOTES. IT IS FAIR TO SAY THAT THESE PRESCRIPTIVE SIZES DO COVER MOST LOADING CONDITIONS- AND THERFORE ARE 'SAFE'.

***COMPARISON_**THE INQUISITIVE ONE WILL DO THE MATH AND SEE HOW THEY COMPARE.

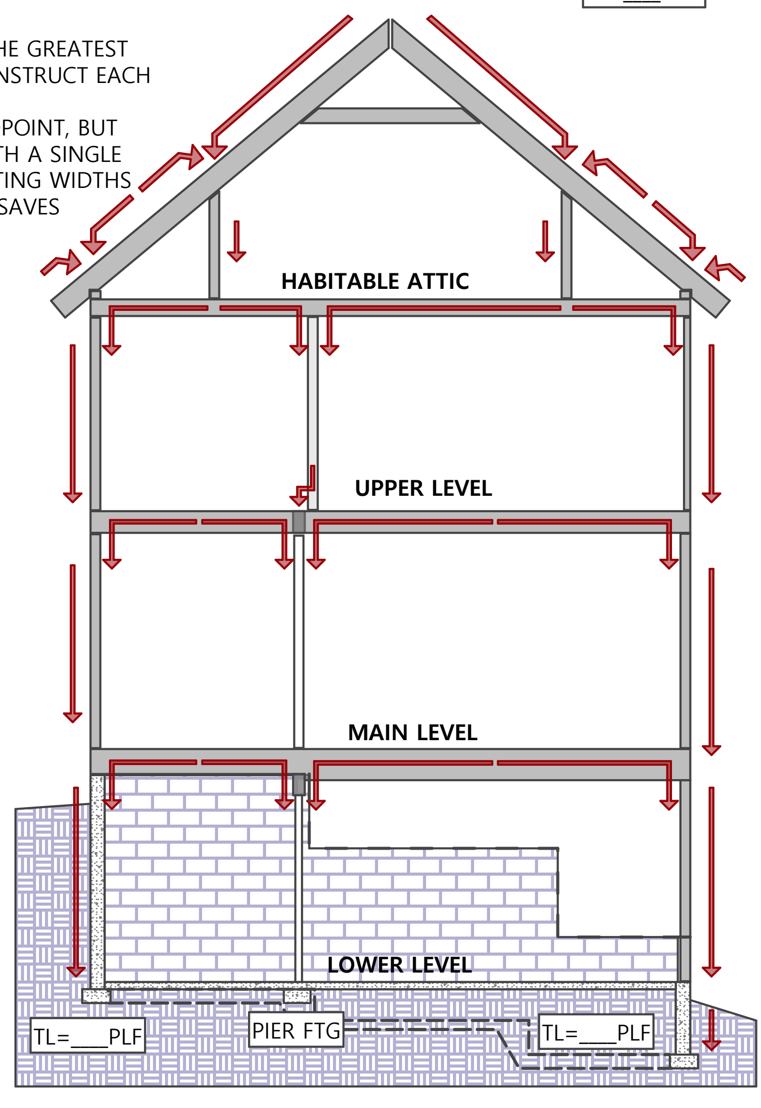


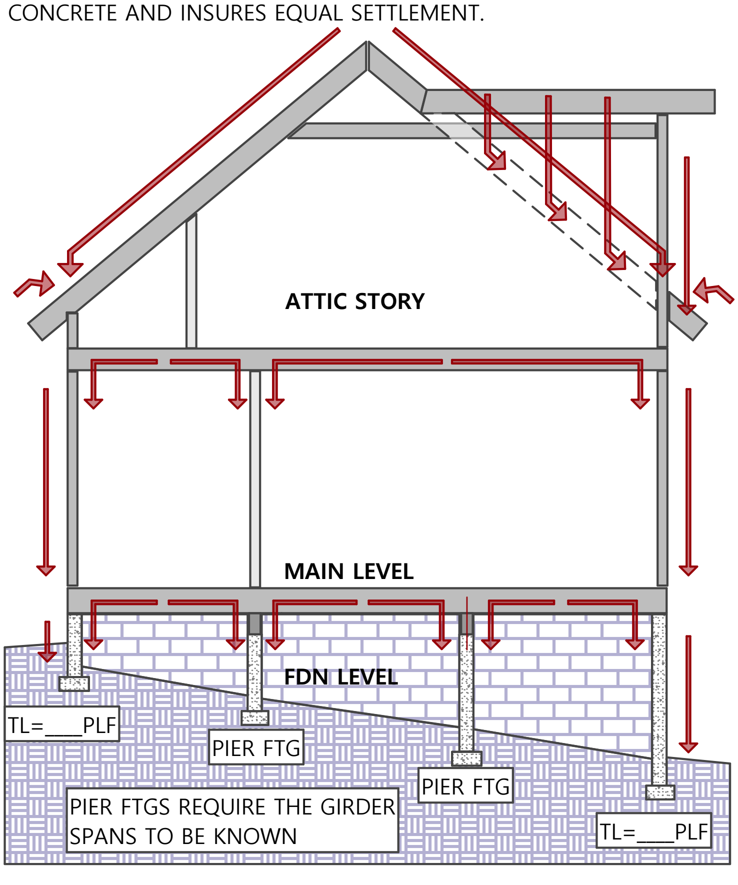


FOOTING STRATEGY

***THESE PROFILES_** IS IT WISE TO SELECT THE FOOTNG CONDITION WITH THE GREATEST LOAD AND SIZE FOOTINGS ACCORDINGLY? OR IT IS WISE TO SIZE AND CONSTRUCT EACH FOOTING BASED ON ITS LOAD AND CONSEQUENT MOST EFFICIENT SIZE?

***PROS+CONS_**THE SINGLE FOOTING SIZE IS SIMPLE FROM A SET UP STANDPOINT, BUT TYPICALLY WASTES A BUNCH OF CONCRETE. (TRENCH POUR FOOTINGS WITH A SINGLE SIZE BACKHOE BUCKET MAY BE STUCK WITH THIS OPTION.) MULTIPLE FOOTING WIDTHS REQUIRE MORE DESIGN ATTENTION, SOME INCREASED SET UP WORK, BUT SAVES CONCRETE AND INSURES EQUAL SETTLEMENT.





CODE FOOTING TABLES

***THIS CHART**_IS FOR NON-REINFORCED CONCRETE FOOTINGS WITH LIGHT FRAME CONSTRUCTION EDITED HERE TO SHOW 20 PSF AND 70 PSF LIVE/SNOW LOADING ONLY. SISTER CHARTS EXIST FOR LIGHT FRAME CONSTRUCTION WITH VENEER (HEAVIER LOADING) AND MASONRY WALL CONSTRUCTION (HEAVIEST LOADING). AS WITH ALL PRESCRIPTIVE CHARTS FOOTNOTES NEED TO BE READ, INTERPRETED, APPLIED.

***LOAD MAX**_THE ADDED RED BOXES TAKE THE 2000 PSF (DEFAULT) SOIL BEARING VALUE AND DIVIDES THE LISTED WIDTHS TO GET THE TOTAL MAX LOAD THE FOOTING IS CAPABLE OF. REPRESENTS A CHECK MECHANISM THAT THE CODE CHART CAN HELP WITH.

***OBSERVATION ON 6" DEPTHS**_2 RESTRICTIONS EXIST WITH 6" DEEP FOOTING. ONE IS THEY CANNOT BE REINFORCED. (10" DEPTH IS THE MIN ACI RECOMMENDATION). THE OTHER IS THAT THE MAX LOAD DISTRIBUTION OF 45^{O} MEANS THE MAX PROJECTION IS 6". WITH A TYPICAL 8" FOUNDATION WALL THIS MEANS THE MAX FOOTING WIDTH IS 20". SO A FOOTING (IN THE CHART) WIDER THAN 20" NEEDS A WIDER FOUNDATION WALL! CODE FIGURE R403.1(1) DIAGRAMS THE (P) PROJECTION, (T) THICKNESS (aka DEPTH)

***OBSERVATION ON 1500 BEARING VALUE**_THE FOOTING SIZES ARE MORE CONDITION SPECIFIC. THESE VARYING SIZES AND DEPTH ARE MATH/ENGINEERING BASED, BUT THIS IS A PLACE FOR THE REMINDER THAT SOILS OFFERING THIS LOWER BEARING VALUE FREQUENTLY WRESTLE WITH WATER, WET(TER) SOIL.

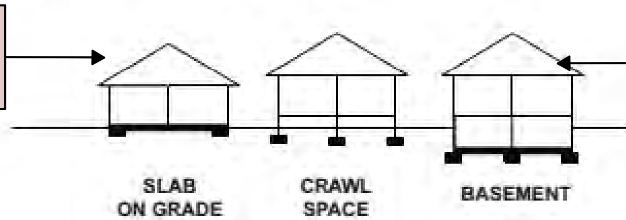
TABLE R403.1(1)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)[a, b]

SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH LIGHT FRAME	LOAD-BEARING VALUE OF SOIL (psf)					
		1500	2000	2500	3000	3500	4000
20 psf	1 story—slab-on-grade	12 × 6	12 × 6 [2000#]	× 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	12 × 6	12 × 6 [2000#]	× 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	18 × 6	14 × 6 [2332#]	× 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	12 × 6	12 × 6 [2000#]	× 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	16 × 6	12 × 6 [2000#]	× 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	22 × 6	16 × 6 [2660#]	× 6	12 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	14 × 6	12 × 6 [2000#]	× 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	19 × 6	14 × 6 [2332#]	× 6	12 × 6	12 × 6	12 × 6
	3 story—plus basement	25 × 8	19 × 6 [3160#]	× 6	13 × 6	12 × 6	12 × 6
70 psf	1 story—slab-on-grade	12 × 6	12 × 6 [2000#]	× 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	18 × 6	13 × 6 [2166#]	× 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	24 × 7	18 × 6 [3000#]	× 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	16 × 6	12 × 6 [2000#]	× 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	21 × 6	16 × 6 [2660#]	× 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	27 × 9	20 × 6 [3320#]	× 6	14 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	19 × 6	14 × 6 [2332#]	× 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	25 × 7	18 × 6 [3000#]	× 6	12 × 6	12 × 6	12 × 6
	3 story—plus basement	30 × 10	23 × 6 [3862#]	× 6	15 × 6	13 × 6	12 × 6

***NOTE ON CHAPTER c2 FOUNDATION STRUCTURE**_DOES A PRETTY GOOD JOB OF OUTLINING FOOTING DESIGNS/CONDITIONS/LIMITATIONS.

b.Based on 32-foot-wide house with load-bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house, add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick).

*ALL HOME CONFIGURATIONS + CONDITIONS CANNOT BE REPRESENTED IN PRESCRIPTIVE SOLUTIONS.



*PEFORMING GRAVITY LOAD SUMMARIES IS A MORE ACCURAGTE, AND SAFER WAY TO DETERMINE BEST FOOTING SIZES

WIND DESIGN CRITERIA BASED ON GEOGRAPHY

NOTE WIND INTRODUCTION/OVERVIEW (d2.12)

WIND SPEED MAP + WIND DESIGN

***FORTUNATELY-FOR DESIGN PURPOSES**_MOST OF THE USA FINDS ITSELF IN A **115** MPH WIND ZONE. BOTH THE CODE AND THIS PROJECT USES THIS SPEED AS THE DEFAULT. SO BASELINE CODE PRESCRIBED CONSTRUCTION TECHNIQUES ARE LARGELY VALID.

***EXCEPTIONS/120 MPH/130 MPH**_ADJUSTMENTS TO THAT BASELINE **115** MPH ZONE, OR BEING LOCATED IN A COASTAL OR MOUNTAIN 120 OR130 ZONE REQUIRES SOME ADDITIONAL CODE INTERPRETATION. BUT REQUIREMENTS TO MEET THOSE DESIGN REQUIREMENTS ARE CONTAINED WITHIN THE IRC CODE.

***CHECK LIST**_A CHECK LIST REVIEW IS SMART- A SELF INSURANCE-. THAT CHECKLIST REVIEW INCLUDES RECOGNIZING WIND DESIGN CRITERION+THOSE EXCEPTIONS CONDITIONAL MODIFICATIONS. THAT CHECKLIST REVIEW THEN CHECKS 'STRUCTURAL' UPLIFT AND COMPONENT AND CLADDING FASTENING. LASTLY THAT REVIEW CHECKS THAT ADEQUATE LATERAL BRACING IS IN PLACE. THIS CHAPTER TRIES TO SUMMARIZE THESE CHECKLIST ITEMS.

***140+ MPH**_THIS WIND MAP AT RIGHT(VIRTUALLY IDENTICAL TO THE BASE WIND MAP (d2.12) SIMPLY DEMARKS WIND SPEED AREAS THAT EXCEED 140 MPH AND THEREFORE REQUIRES 'DESIGN' (PROFESSIONAL ENGINEERING) HELP. CODE SECTION **R301.2.1.1** NOTES THIS, AND LISTS OTHER ACCEPTABLE AND RECOGNIZED DESIGN STANDARDS THAT NEED TO BE FOLLOWED. (SUCH AS THE **ASCE** (**A**MERICAN **S**OCIETY OF **C**IVIL **E**NGINEERS) 7 REFERENCE GUIDE WHICH IS A CORE SOURCE FOR ALL WIND BASED DESIGN.

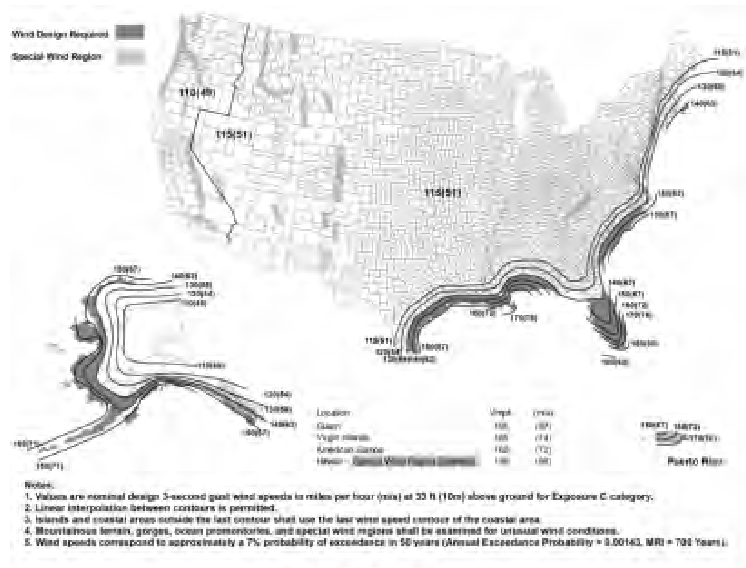


FIGURE R301.2(5)B
REGIONS WHERE WIND DESIGN IS REQUIRED

WIND SPEED CONDITIONS

***GENERAL**_WIND SPEED IS EFFECTED BY GEOGRAPHIC CONDITIONS. OPEN SPACE AND HIGHER ELEVATIONS ENCOURAGE THE WIND TO 'SPEED UP'. COMPLICATED OR CONGESTED SPACE INTERFERES WITH THE WIND AND PREVENTS ITS ACCELERATION. BELOW IS THE WAY THE IRC CODE DEALS WITH THESE VARIABLES.

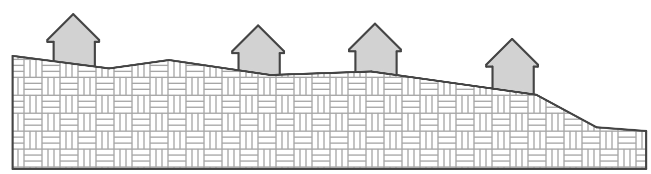
EXPOSURE CATAGORIES R301.2.1.4

***WHAT IS IT?**_THE SETTING OF A STRUCTURE RELATIVE TO HOW WIND SPEED MIGHT BE EFFECTED. THE MOST COMMON IS EXPOSURE B WHICH IS THE BASE LINE FOR THESE WIND PRESCRIPTIVE REQUIREMENTS.

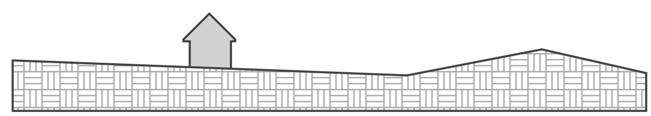
***EXPOSURE B** _URBAN AND SUBURBAN.THE DEFAULT SITE CONDITION WITH TREES AND OR HILLS AND OR NEIGHBORING STRUCTURES THAT WILL DISTRUPT THE WIND AND EFFECTIVELY BRAKE ITS ACCELERATION.

***EXPOSURE C**_ OPEN TERRAIN WITH SCATTERED OBSTRUCTIONS OR SURFACE UNDULATIONS.

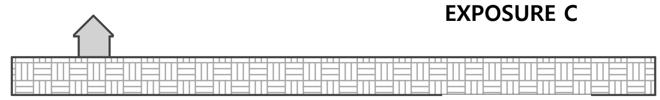
***EXPOSURE D**_SERIOUSLY AND CONSISTENTLY FLAT TERRAIN WITH NO SIGNIFICANT INTERUPTIONS EXTENDING 5000'.



EXPOSURE B



EXPOSURE C

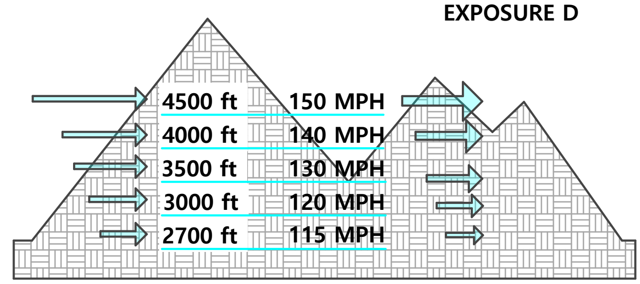


EXPOSURE D

MOUNTAIN TOPOGRAPHY R301.2(5)

***ELEVATION**_CONSISTENT WITH THE GENERAL IDEA OF WIND SPEEDS BEING GREATER AT HIGHER ELEVATIONS IS A COEFFICIENT INCREASING WIND LOADS/REQUIREMENTS AS HEIGHT ABOVE SEA LEVEL INCREASES. THE ENGINEERS USE A COEFFICIENT Ke ADJUSTING THE WIND LOAD.

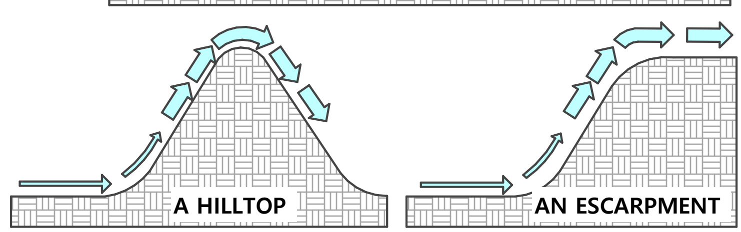
***SPECIAL WIND REGIONS_(d2.12)**AT RIGHT A LOCAL WIND SPEED ADJUSTMENT FOR A SPECIAL WIND REGION IN THE BLUE RIDGE MOUNTAINS IN NORTH CAROLINA. IN THIS INSTANCE THE DESIGN WIND SPEED IS INCREASED AS ELEVATION INCREASES.



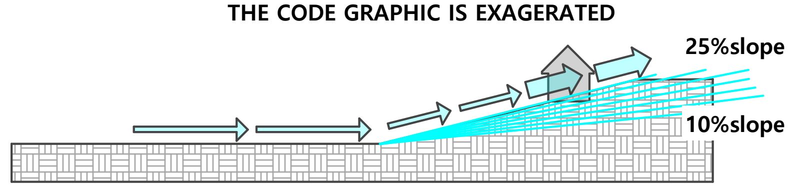
TOPOGRAPHIC WIND EFFECT R301.2.1.5

***DESIGNATED WIND 'SPEED-UP' AREAS**_THERE IS A SERIES OF CONDITIONS THAT ARE CODE OUTLINED THAT REQUIRE CONSIDERATION OF AN INCREASE IN WIND SPEED. TABLE R301.2.1.5.1 SPECIFIES THESE INCREASES.

***THE TAKE AWAY IDEA**_WIND IS CAPABLE OF SPEEDING UP WHEN UNOBSTRUCTED. AN ADDITIONAL ACCELERATION BECOMES POSSIBLE WHEN AN ELEVATION CHANGE OCCURS AND THEN PASSES AN 'APEX'. THIS, ON A MUCH SMALLER SCALE, OCCURS WHEN WIND OF ANY VELOCITY TURNS ANY CORNER OR EDGE AROUND A STRUCTURE .



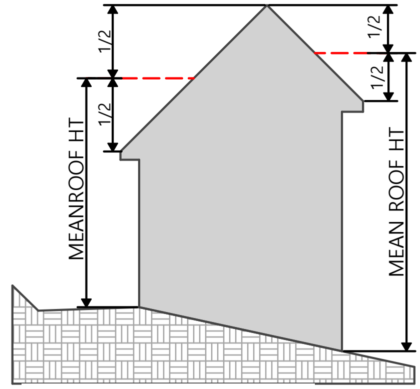
THE CODE GRAPHIC IS EXAGERATED



A MORE REASONABLE GRAPHIC REPRESENTATION

MEAN ROOF HEIGHT

***WHAT IS IT?**_THE HT FROM THE VERTICAL MIDPOINT OF THE ROOF TO THE GROUND. A GIVEN HOME DESIGN MAY HAVE A DIFFERENT MEAN ROOF HT FOR EACH HOUSE PLANE. IT IS PRACTICAL TO SELECT THE TALLEST MEAN ROOF HT CONDITION AND USE IT AS THE BASELINE.
***HEIGHT IN GENERAL**_WIND SPEEDS ARE GREATER AT HIGHER ELEVATIONS. THE ENGINEERING COMMUNITY HAS ESTABLISHED COEFFICIENTS THAT INCREASE DESIGN LOADS/REQUIREMENTS AS HEIGHT INCREASES. BECAUSE HOMES HUG THE GROUND THESE COEFFICENTS ARE PRETTY MODEST. SKYSCRAPERS DO NOT HUG THE GROUND AND SERIOUSLY MUST DEAL WITH INCREAING WIND SPEED BASED ON ELEVATION.
***UP TO 30' IS THE BASELINE HEIGHT**_BELOW WHICH NO ADJUSTMENTS ARE REQUIRED. WIND LOAD/REQUIREMENTS INCREASE AS THAT MEAN ROOF HT INCREASES. THESE ADJUSTMENT FACTORS ARE LISTED IN TABLE R301.2(3). AS NOTED (c8.5) THE DESIGNS THIS PROJECTS WILL SELDOM EXCEED 40' MEAN ROOF HT.



MEAN ROOF HEIGHT

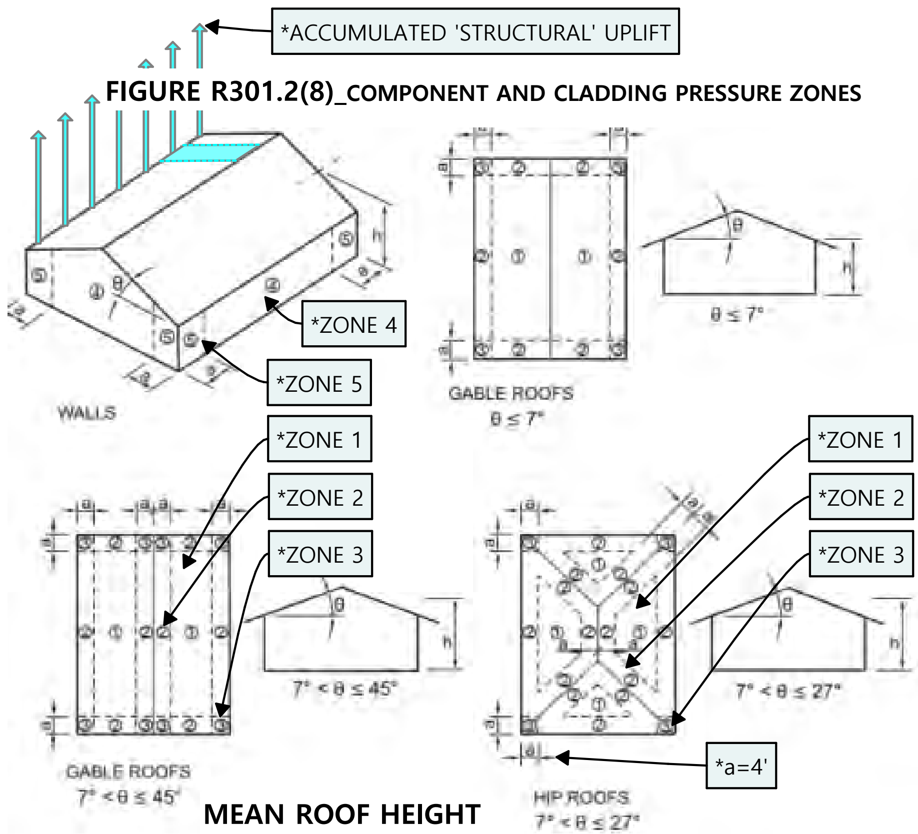
STRUCTURAL UPLIFT

***ARROWS**_REPRESENT THE GATHERED AREA LOAD FOR A ROOF STRUCTURAL MEMBER AT AN OUTSIDE WALL. FREQUENTLY/USUALLY THIS POINT OF CONCENTRATION IS BOTH A GRAVITY LOAD AND AN UPLIFT LOAD.
***UPLIFT**_EXPLAINED c8.6, c8.7

COMPONENTS AND CLADDING

***DEFINED**_ALL THE PIECES AND PARTS ATTACHED TO THE STRUCTURE, ALL OF WHICH ARE SUBJECT TO BEING BLOWN OFF OR SUCKED OFF THE HOUSE. THE COMPONENT AND CLADDING IRC CHART BASICALLY ESTABLISHES PRESSURES WHICH IN TURN ESTABLISHES FASTENING REQUIREMENTS.
***IRC DIAGRAMS**_THE FUZZY SMALL IMAGES ARE FROM THE 2018 IRC. THESE ARE PART OF THE COMPONENTS AND CLADDING WIND PRESSURE ADJUSTMENT PACKAGE. SEE NEXT SHEET. PRESSURES CAN INCREASE ON THE WALL CORNERS (ZONE 5), AND ON THE 'EDGES' (ZONE 2,3) ON THE ROOF. THESE INCREASES ARE ALMOST ALWAYS ON THE LEEWARD SIDE.
***SIMILAR DIAGRAMS**_ARE MORE DETAILED IN THE ENGINEERS MORE SOPHISTICATED WORLD OF WIND DESIGN. (SEE NOTES THIS TABLE OF CONTENTS) BUT THESE SAME BASIC LOCATIONS FOR PRESSURE INCREASES -AT THE WALL CORNERS- AND THE ROOF 'EDGES'- ARE THE SAME.
***COMPONENTS AND CLADDING CHART**_CONFUSING MAYBE AT FIRST-STICK WITH IT AND IT ALL MAKES SENSE. SEE (c8.7) FOR A PRACTICAL EXPLANATION OF WHAT TO DO WITH THESE PRESSURE VALUES.

FIGURE R301.2(8)_COMPONENT AND CLADDING PRESSURE ZONES



WINDWARD AND LEEWARD BEHAVIOR

***GENERAL**_WIND HITS SOMETHING (POSITIVE PRESSURE), HUSSLES UP TO MOVE AROUND IT, AND MOVES ON, PULLING AT THAT SOMETHING (NEGATIVE PRESSURE) AS IT EXITS. THE WINDWARD SIDE IS THE PUSH SIDE. THE LEEWARD SIDE IS THE PULL SIDE. THE LEEWARD SIDE HAS MORE POTENT PRESSURES.
***FROM THE CHARTS**_CONDITIONS ARE: ROOF PITCH ABOVE 27 DEGREES, 10 SQUARE FT AREA (THE GREATEST PRESSURE PSF), 115 WIND SPEED. 13.1 PSF LISTED CONSISTENTLY REGARDLESS OF ZONE OR SQUARE FOOTAGE. -16 PSF LISTED FOR ZONES 2 AND 3, AND -14 PSF LISTED FOR ZONE 1. THERE IS AN INCREASE IN PRESSURE AND A ZONE DISTINCTION ON THE NEGATIVE PRESSURE LEEWARD SIDE.
***DITTO THE WALLS**_THE POSITIVE PRESSURE SIDE IS THE SAME IN ZONES 4 AND 5 AT 14.3 PSF. THE NEGATIVE PRESSURE IS GREATER PULLING AT THE CORNERS AT -19 PSF AND ACROSS MOST OF THE INTERNAL SURFACE AT -15 PSF.
***THINKING WIND DIRECTION**_MOST OFTEN WIND DIAGRAMS AND CALCULATIONS ASSUME THE WIND DIRECTED AT, AND PULLING AWAY, FROM ANY SURFACE AT 90° OR PERPENDICULARLY. THE PRESSURE IS GREATEST AT THAT ANGLE AND BECOMES THE DESIGN PARAMETER. KEEP IN MIND THE WIND IS TRUELY MULTIDIMENSIONAL. FOR EXAMPLE WIND ATTACKING A WALL PERPENDICULARLY MAY ACTUALLY KEEP THOSE COMPONENTS AND CLADDING QUITE IN PLACE, BUT SHIFT THAT POSITIVE PRESSURE TO A MORE OBLIQUE ANGLE AND GET AIR UNDER A PIECE OF SIDING OR ROOFING AND THE SITUATION CHANGES.

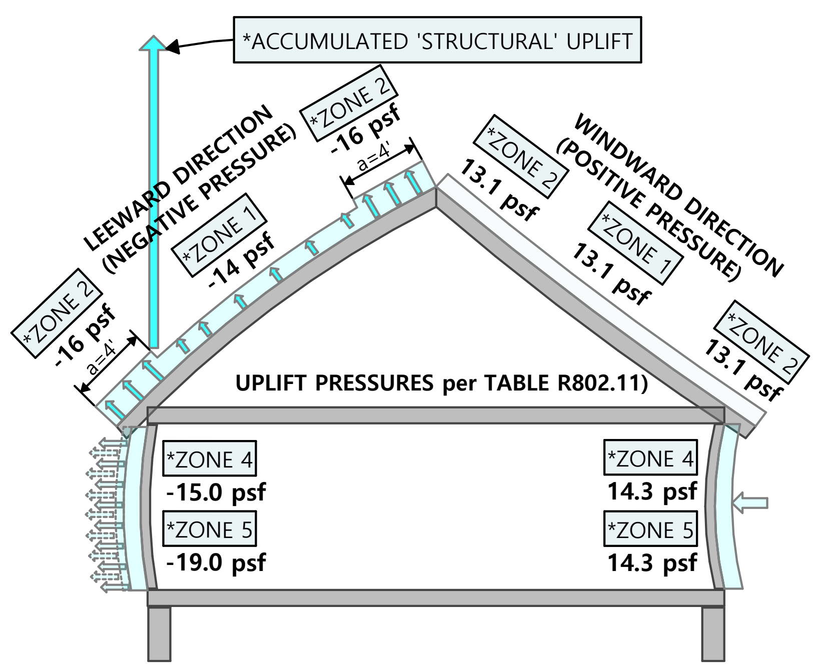


TABLE R301.2(2)

COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf)[a, b, c, d, e]

	ZONE	EFFECTIVE WIND AREA (feet²)	ULTIMATE DESIGN WIND SPEED, V_{ULT} (mph)																	
			110		115		120		130		140		150		160		170		180	
							10.0	-15.0	10.0	-18.0	10.0	-21.0								
							10.0	-15.0	10.0	-17.0	10.0	-20.0								
							10.0	-14.0	10.0	-17.0	10.0	-19.0								
	1	100	10.0	-11.0	10.0	-13.0	10.0	-14.0	10.0	-16.0	10.0	-19.0	7.8	-22.0	10.0	-25.0	10.0	-28.0	11.3	-32.0
Roof 0 to 7 degrees (FLAT TO 1.5 IN 12 PITCH)	2	10	10.0	-21.0	10.0	-23.0	10.0	-26.0	10.0	-30.0	10.0	-35.0	9.9	-40.0	11.2	-46.0	12.6	-52.0	14.2	-58.7
	2	20	10.0	-19.0	10.0	-21.0	10.0	-23.0	10.0	-27.0	10.0	-31.0								
	2	50	10.0	-16.0	10.0	-18.0	10.0	-19.0	10.0	-23.0	10.0	-26.0								
	2	100	10.0	-14.0	10.0	-15.0	10.0	-16.0	10.0	-19.0	10.0	-22.0	7.8	-26.0	10.0	-30.0	10.0	-33.0	11.3	-37.9
	3	10	10.0	-33.0	10.0	-36.0	10.0	-39.0	10.0	-46.0	10.0	-53.0	9.9	-61.0	11.2	-69.0	12.6	-78.0	14.2	-88.3
	3	20	10.0	-27.0	10.0	-29.0	10.0	-32.0	10.0	-38.0	10.0	-44.0	9.2	-50.0	10.6	-57.0	11.9	-65.0	13.3	-73.1
																				-53.1
																				-37.9
																				-32.0
																				-31.1
																				-29.9
																				-29.0
Roof > 7 to 27 degrees (1.5 IN 12 PITCH TO 6.125 IN 12 PITCH)	2	10	10.0	-20.0	10.0	-22.0														-55.8
	2	20	10.0	-19.0	10.0	-20.0														-51.2
	2	50	10.0	-16.0	10.0	-18.0														-45.4
	2	100	10.0	-15.0	10.0	-16.0														-40.9
	3	10	10.0	-30.0	10.0	-33.0														-82.4
																				-77.0
							10.0	-31.0	10.0	-36.0	10.0	-42.0	11.1	-48.0	12.7	-55.0	14.3	-62.0	16.0	-69.9
	3	100	10.0	-24.0	10.0	-26.0	10.0	-28.0	10.0	-33.0	10.0	-39.0	9.9	-44.0	11.2	-51.0	12.6	-57.0	14.2	-64.6
Roof > 27 to 45 degrees (6.125 IN 12 PITCH TO 12 IN 12 PITCH)	1	10	11.9	-13.0	13.1	-14.0	14.2	-15.0	16.7											
	1	20	11.6	-12.0	12.7	-13.0	13.8	-14.0	16.2											
	1	50	11.2	-11.0	12.2	-12.0	13.3	-13.0	15.6											
	1	100	10.9	-10.0	11.9	-11.0	12.9	-12.0	15.1	-15.0	17.6	-17.0	20.2	-20.0	22.9	-22.0	25.9	-25.0	29.0	-29.0
	2	10	11.9	-15.0	13.1	-16.0	14.2	-18.0	16.7									-36.0	32.0	-40.9
	2	20	11.6	-14.0	12.7	-16.0	13.8	-17.0	16.2									-34.0	31.1	-39.1
	2	50	11.2	-13.0	12.2	-15.0	13.3	-16.0	15.6	-19.0	18.1	-22.0	20.8	-25.0	23.6	-29.0	26.7	-32.0	29.9	-36.8
	2	100	10.9	-13.0	11.9	-14.0	12.9	-15.0											29.0	-35.0
	3	10	11.9	-15.0	13.1	-16.0	14.2	-18.0											32.0	-40.9
	3	20	11.6	-14.0	12.7	-16.0	13.8	-17.0	16.2										31.1	-39.1
	3	50	11.2	-13.0	12.2	-15.0	13.3	-16.0											29.9	-36.8
	3	100	10.9	-13.0	11.9	-14.0	12.9	-15.0	15.1	-18.0	17.6	-21.0	20.2	-24.0	22.9	-27.0	25.9	-31.0	29.0	-35.0
Wall	4	10	13.1	-14.0	14.3	-15.0														
	4	20	12.5	-13.0	13.6	-14.0														
	4	50	11.7	-12.0	12.8	-14.0														
	4	100	11.1	-12.0	12.1	-13.0														
	4	500	10.0	-10.0	10.6	-11.0														
	5	10	13.1	-17.0	14.3	-19.0														
	5	20	12.5	-16.0	13.6	-17.0														
	5	50	11.7	-14.0	12.8	-16.0														
	5	100	11.1	-13.0	12.1	-14.0														
	5	500	10.0	-10.0	10.6	-11.0	11.6	-12.0	13.6	-15.0	15.8	-17.0	18.1	-20.0	20.6	-22.0	23.2	-25.0	26.1	-29.0

TABLE R301.2(3)

HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR TABLE R301.2(2)

MEAN ROOF HEIGHT	EXPOSURE		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

*CHECKING OUT THESE NEGATIVE PRESSURES FOR FLAT ROOFS AND HIGHER WIND SPEEDS GETS ONE'S ATTENTION.
*THAT ALMOST OVERKILL SINGLE NAIL NOTED BELOW TO KEEP OUR SIDING SNUG IN 115 MPH WINDS WON'T DO THE JOB HERE.

*1ST COLUMN -POSITIVE PRESSURE

*2ND COLUMN -NEGATIVE PRESSURE

*REMINDER- WIND SPEEDS ABOVE 140 REQUIRE PROFESSIONAL DESIGN

*A HIGHER MEAN ROOF HEIGHT REQUIRES MULTIPLING THE CHART DERIVED PRESSURE BY THIS FACTOR (FOR A 40'MEAN ROOF HT)
*16.0 PSF FOR A 30' MEAN ROOF HT X 1.09 =-17.44# FOR A 40' HIGH MEAN ROOF HT.
*THIS PROJECT LIKELY NOT TO SHOW DESIGNS WITH MEAN ROOF HTS OVER 40'. STARTER CASTLE DESIGNS DO EXCEED THAT 40'.

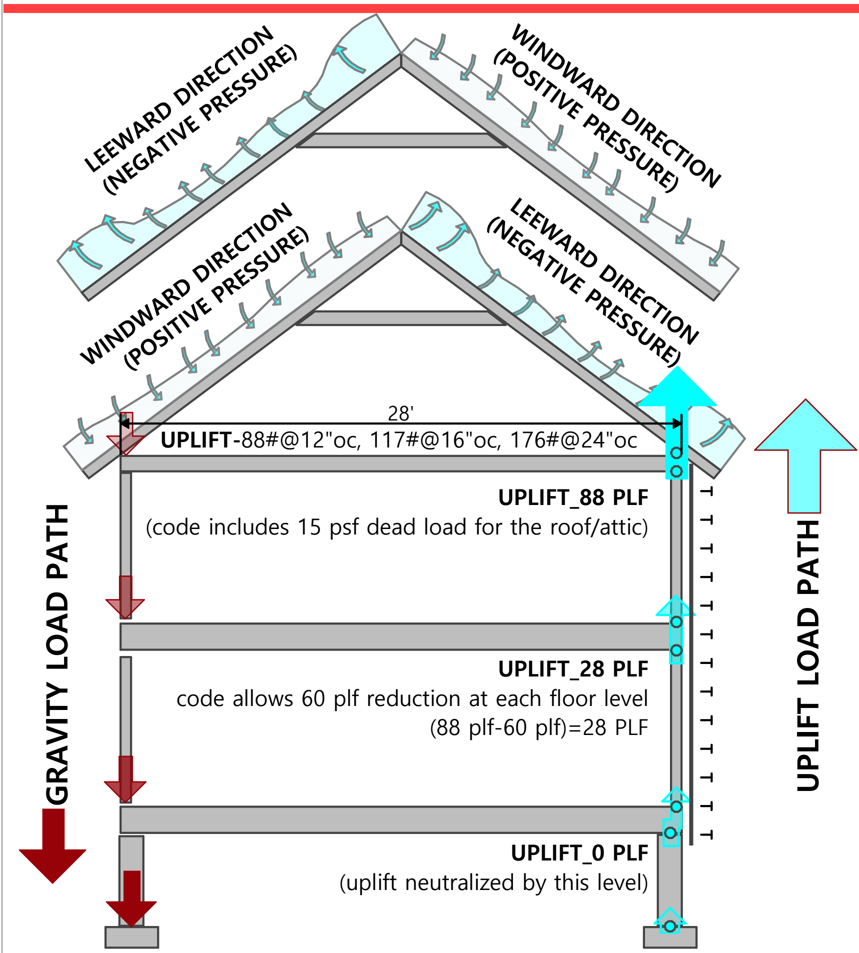
*IN EVERY INSTANCE THE LEEWARD NEGATIVE PRESSURE IS HIGHER THAN THE WINDWARD POSITIVE PRESSURE

*THIS IS THE CHART AREA APPLICABLE TO A PITCHED ROOF WITH 6:12 PITCH OR GREATER, EXPOSURE B, 30' MEAN ROOF HT OR LESS, AND 115 MPH ZONE.

*NOTE THE DECREASE IN PRESSURE WHEN SPREAD OVER A LARGER SQUARE FT AREA.

*CONSERVATIVE (AND SIMPLER) APPROACH IS TO TAKE THE SMALLER SQUARE FOOTAGE AND THE TOUGHER ZONE LOCATION AS A BASELINE

*CONTINUATION OF THE HOW 'MANY NAILS' CONVERSATION- TAKE A TYPICAL HORIZONTAL SIDING PRODUCT WITH A 7" EXPOSURE. STANDARD INSTALL WOULD HAVE 1 BLIND NAIL EVERY 16" OR 1 NAIL FOR EVERY .77 SQ FT REQUIRING EACH NAIL TO RESIST 16# PSF X .77 SQ FT OR 13#. A 6D NAIL THRU OSB INTO A STUD WILL GENERATE ABOUT 45# OF RESISTANCE.
*SO FOR THIS 115 MPH ZONE NAILING REQUIREMENTS ARE TYPICALLY LESS THAN WOULD BE EXECUTED AS A MATTER OF COURSE.
*SEE CODE TABLE 703.3(1) FOR STANDARD NIMIMUM NAILING REQUIREMENTS FOR DIFFERENT SIDING PRODUCTS-AND NOTE THE CODE REFERENCES MANUFACTURERS INSTALLATION REQUIREMENTS



UPLIFT

***WIND DIRECTION**_THIS FLIP FLOP ILLUSTRATION IS SUGGESTING THE WIND DIRECTIOIN CHANGES AND IS NOT ALWAYS PREDICTABLE. THEREFORE THE WORST CASE WIND CONDITION NEEDS TO BE CONSIDERED AS A DESIGN BASELINE. ESTABLISHED IN THE COMPONENT AND CLADDING CHART IS THE HIGHER LEEWARD SIDE NEGATIVE PRESSURES. THESE MAY OCCUR ON ANY SIDE OF THE ROOF, AND THESE ARE
***LOAD PATH-GRAVITY**_FROM ROOF TO FOOTING. LIVE AND DEADS LOADS ACCUMULATE UNTIL DOWN TO THE FOOTING.
***LOAD PATH-UPLIFT**_SAME IDEA WORKING THE OTHER WAY. THE HIGHEST UPLIFT LOAD WILL BE AT THE ROOF PLANE. BECAUSE DEAD LOAD IS AN ANCHOR TO THAT UPLIFT, IT CAN BE DEDUCTED FROM THE UPLIFT LOADING. IN THIS MODEST 115 WIND SPEED ZONE THAT DEAD LOAD WILL NEUTRALIZE THE UPLIFT. IN HIGH WIND ZONES THIS UPLIFT CAN BE SUBSTANTIAL ENOUGH TO REQUIRE TRACKING TO THE FOOTING LEVEL AND EVEN REQUIRE FOOTINGS TO BE WIDENED TO INCREASE SOIL DEAD LOAD ON THE FOOTING.
***CODE REDUCTION FOR DEAD LOAD**_ALLOWS/INCLUDES 15 PSF FOR THE ROOF CEILING CONSTUCTION DEADLOAD. BELOW IT ALLOWS A NET DEDUCTION OF 60 PLF FOR ANY/EACH FLOOR BELOW THAT ROOF PLANE. THESE DEDUCTIONS ARE PRESCRIPTIVE AND HAVE TO BE CONSERVATIVE.
***LOAD PATH CONNECTIONS**_FROM ROOF TO FOOTING THE BUILDING COMPONENTS NEED TO BE CONNECTED ONE TO THE OTHER IN ORDER THAT UPLIFT IS CARRIED/CONNECTED DOWN TO THE FOOTING-THOSE DEAD LOADS NEED TO BE CONNECTED SO THEIR EFFECT IS ACCUMULATIVE. WITH 115 MPH LOADING THESE CONNECTION CONCERNS ARE MANAGED BY GENERAL CODE REQUIRED CONSTRUCTION. AND IN HIGH WIND DESIGNS THESE (INTER)CONNECTIONS REQUIRE SPECIAL ATTENTION.

R802.11 Roof tie-down.

TABLE R802.11
RAFTER OR TRUSS UPLIFT CONNECTION FORCES FROM WIND (ASD) (POUNDS PER CONNECTION)[a, b, c, d, e, f, g, h]

RAFTER OR TRUSS SPACING	ROOF SPAN (feet)	EXPOSURE B — Ultimate Design Wind Speed V_{ULT} (mph)									
		110 Roof Pitch		115 Roof Pitch		120 Roof Pitch		130 Roof Pitch		140 Roof Pitch	
		< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12
12" o.c.	12	48	43	59	53	70	64	95	88	122	113
	18	59	52	74	66	89	81	122	112	157	146
	24	71	62	89	79	108	98	149	137	192	178
	28	79	69	99	88	121	109	167	153	216	200
	32	86	75	109	97	134	120	185	170	240	222
	36	94	82	120	106	146	132	203	186	264	244
	42	106	92	135	120	166	149	230	211	300	278
	48	118	102	151	134	185	166	258	236	336	311
16" o.c.	12	64	57	78	70	93	85	126	117	162	150
	18	78	69	98	88	118	108	162	149	209	194
	24	94	82	118	105	144	130	198	182	255	237
	28	105	92	132	117	161	145	222	203	287	266
	32	114	100	145	129	178	160	246	226	319	295
	36	125	109	160	141	194	176	270	247	351	325
	42	141	122	180	160	221	198	306	281	399	370
	48	157	136	201	178	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24" o.c.	12	96	86	118	106	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	18	118	104	148	132	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	24	142	124	178	158	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	28	158	138	198	176	242	218	334	306	432	400
	32	172	150	218	194	268	240	370	340	480	444
	36	188	164	240	212	292	264	406	372	528	488
	42	212	184	270	240	332	298	460	422	600	556
	48	236	204	302	268	370	332	516	472	672	622

*SIMPLE MATH REVERTING THESE CODE DERIVED TOTAL LOADS TO LOADS PSF. DIVIDE THE LOAD IN THE CHART BY THE TRIBUTARY AREA.

TABLE R802.11

***115 mph**_IS HIGHLIGHTED AS IT COVERS SUCH A HIGH PERCENTAGE OF THE USA..THIS CHART ALSO CUTS OFF AT 140 MPH AS WIND SPEEDS ABOVE 140 REQUIRE ENGINEERING DESIGN.
***ROOF PITCH**_SIMPLE BREAK AT 5:12. PRESSURES OBVIOUSLY HIGHER AT LOWER PITCHES. (DITTO THE COMPONENTS AND CLADDING CHARTING-LOWER ROOF PITCHES HAVE HIGHER DESIGN PRESSURES).
***ROOF SPAN**_FROM 12' TO 48', IMPLYING A RAFTER OR TRUSS 'HALF' TRIBUTARY SPAN OF 6' TO 24'.
***CENTERS**_12", 16", 24". TRIBUTARY AREA INCREASES AND LOADS INCREASE. WIDER CENTERS INCREASE SURFACE AREA AND PRESSURE LOADING PROPORTIONALLY.
***DEAD LOAD**_THESE DESIGN LOADS CONSIDER 15 PSF CEILING/ROOF DEAD LOADS.
***OVERHANGS**_UP TO 2' ARE INCLUDED
***8' FROM CORNER REDUCTION** _MULTIPLY BY .75 .THIS CORRESPONDS TO THE C+C ZONE 1 AND ZONE 2 DIFFERENTIAL PRESSURES.
***HIP ROOF REDUCTION**_MULTIPY BY .70
***NOTE ON EXPOSURE C**_SISTERED BELOW THIS EXPOSURE B CHART IN THE CODE BOOK ARE DESIGN LOADS FOR EXPOSURE C (SITES). THAT 117# LOAD FOR A RAFTER WITH A 14' SPAN INCREASES TO 238# IF/WHEN IN AN EXPOSURE C SITE CONDITION.

CODE QUALIFIERS FOR 'STRUCTURAL' UPLIFT

****R802.11.1 UPLIFT RESISTANCE_** LISTS A COUPLE STANDARD DESIGN CONDITIONS THAT ALLOW ONE TO USE THE CODE STANDARD NAILING FOR TRUSSES AND RAFTERS SHOWN IN TABLE R602.3(1) BELOW. THIS TABLE IS FAIRLY EXPANSIVE AND INCLUDES NAILING REQUIREMENTS FOR MANY/MOST STANDARD FASTENING SITUATIONS. ITEM 6 BELOW IS REPRESENTING THAT RAFTER TO WALL PLATE CONNECTION ONLY.

***200 # AND UNDER_**IN FACT BECOMES A CODE THRESHOLD FOR PERMITTING THE USE OF THE STANDARD NAILING SCHEDULE BELOW. WHEN PRESSURE EXCEEDS 200# THEN A VERIFIED RESISTANCE TECHNIQUE BECOMES REQUIRED. BELOW NOTED 2 WAYS TO GO ABOUT THIS. OBVIOUSLY THE FIRST STEP IS TO USE THE UPLIFT CHART TO QUANTIFY THE RESISTANCE REQUIRED.

TABLE R602.3(1)
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		Roof	
6	Rafter or roof truss to plate	3-16d box nails ($3^1/_2$" × 0.135"); or 3-10d common nails (3" × 0.148"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss[i]

*SIMPLE REQUIREMENT FOR MANY RAFTER TO WALL PLATE CONNECTIONS
*THESE ARE ANGULAR 'TOE NAILS'

BY DEDUCTION, 66#RESISTANCE PER NAIL

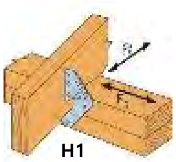
BY DEDUCTION, 50#RESISTANCE PER NAIL

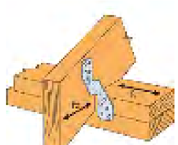
FASTENING CHOICES

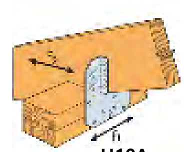
***TOTAL RESISTANCE VALUE BY FASTENER UNIT_**RESISTANCE VALUES IN POUNDS EXIST FOR FASTENERS. THE VARIABLES INCLUDE THE FASTENER MATERIAL TYPE, THE ANGLE OF THE FASTENER'S INSTALLATION, THE DEPTH OF INSTALLATION, THE TYPE OF WOOD. GETTNG TO A REAL VERIFIABLE VALUE CAN BE TRICKY. HAVING SAID THAT ANOTHER APPROACH IS TO USE THE CODE TO ESTABLISH THE UNIT VALUE. IF THE ABOVE 3 OR 4 NAIL REQUIREMENT IS GOOD FOR 200#, WHICH THE CODE IS ESSENTIALLY VERIFYING, THEN THE UPLIFT RESISTANCE OF EACH NAIL IS 66# OR 50# RESPECTIVELY. ADD A NAIL OR 2 AND THE UPLIFT VALUES INCREASE ACCORDINGLY. THE EVER PRESENT CONDITION WITH FASTENER COUNT IS THAT THEY BE ALLOWED ENOUGH 'WOOD SPACE' TO WORK AND DO THE JOB. OVERCROWDED NAILING IS INEFFECTIVE TO DANGEROUS.

***RESISTANCE VALUE USING RATED FASTENERS_**HIGHLY RECOMMENDED BECAUSE THE VERIFICATION AND NAILING REQUIREMENTS ARE ESTABLISHED AND PRE-APPROVED. THE BELOW CHART FOR THE 3 (OF MAYBE 20) DIFFERENT SIMPSON FASTENERS (aka HURRICANE TIES) PROVIDE VALUES FOR UPLIFT- AND RESISTANCES IN THE F1 AND F2 DIRECTIONS. THE VARIABLES CAN BE THOROUGHLY SEARCHED ON THE VERY COMPLETE SIMPSON WEB SITE. RANDOMLY USING THE H1 CLIP BELOW AS AN EXERCISE THE CHART DISPLAYS___MODEL/STEEL GUAGE OF THE CONNECTOR CONSTRUCTION/FASTENERS-NO+SIZE OF NAILS-/MATERIAL BEING FASTENED INTO-DF/SP IS DOUGLAS FIR AND SOUTHERN PINE-SPF/HF IS SPRUCE PINE FIR AND HEMLOCK AND FIR. THE UPLIFT RATING OF 425# IS WHAT IS IMPORTANT THIS TOPIC, AND IS WELL BEYOND THE 200# BASELINE NOTED ABOVE.

Model No.	Ga.	Fasteners (in.) To Rafters/ Truss	Fasteners (in.) To Plates	Fasteners (in.) To Studs	DF/SP Allowable Loads Uplift (160)	DF/SP Lateral (160) F_1	DF/SP Lateral (160) F_2	Uplift with 0.131" x 1½" Nails (160)	SPF/HF Allowable Loads Uplift (160)	SPF/HF Lateral (160) F_1	SPF/HF Lateral (160) F_2	Uplift with 0.131" x 1½" Nails (160)
H1	18	(6) 0.131 x 1½	(4) 0.131 x 2½	—	490	510	190	455	425	440	165	370
H2.5A	18	(5) 0.131 x 2½	(5) 0.131 x 2½	—	[illegible]	110	110	575	535	110	110	495
H10A	18	(9) 0.148 x 1½	(9) 0.148 x 1½	—	1,140	565	285	—	1,015	485	285	—


H1


H2.5


H10A

DETERMINING PRESSURES USING TRIBUTARY AREA

***C+C PRESSURES_**USING THE WIND SPEED (115), CHECK THE ROOF PITCH, CHECK THE ZONE LOCATION ON THE ROOF, AND SELECT THE PRESSURE APPROPRIATE TO THE SQUARE FOOTAGE CATEGORY OF THE TRIBUTARY AREA.

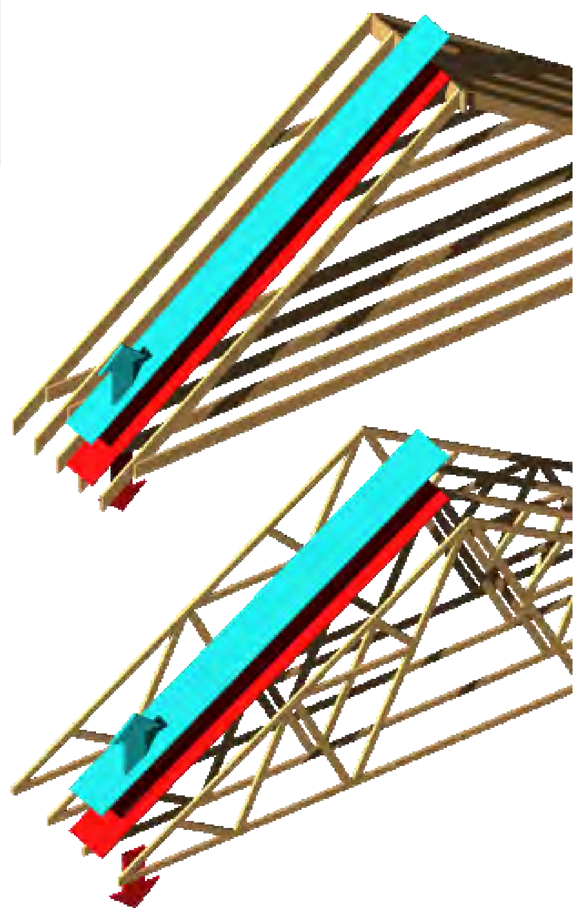
***TRIBUTARY AREA_**SAME AS WITH GRAVITY LOADING. TAKE THE SPAN, THE OVERHANG AND MULTIPLY BY THE SPACING BETWEEN ROOF MEMBERS.

***MULTIPLY_**THE PRESSURE x THE AREA.

***COMPARISONS_** THESE VALUES BELOW INDICATE MUCH HIGHER UPLIFT PRESSURES THAN IN THE CODE CHART.

***WHY_**THE CODE UPLIFT TABLE IS USING THE **MWFRS (**MAIN WIND FORCE RESISTING SYSTEM) METHOD, NOT THE **C+C** (COMPONENTS AND CLADDING) METHOD. THE MWFRS IS TREATING THE ROOF RAFTERS OR TRUSSES AS A 'SYSTEM' WHERE THE COOPERATION OF REPETITIVE PARTS LESSENS THE DEMAND ON AN INDIVIDUAL MEMBER. (SEE THE NOTE IN THE TABLE OF CONTENTS THIS CHAPTER REGARDING MWFRS AND ASCE.

***BOTTOM LINE_**STICK WITH CODE TABLE R806.X(X) FOR UPLIFT REQUIREMENTS AND INTERPOLATE AS REQUIRED SPAN CONDITIONS DON'T EXACTLY MATCH.



115 mph 5in12 PITCH
ZONE 1-14'+2'x1.33'x12psf=255
ZONE 2-14'+2'x1.33'x20psf=426
ZONE 3-14'+2'x1.33'x31psf=660

115 mph 7in12 PITCH
ZONE 1-14'+2'x1.33'x13psf=277
ZONE 2-14'+2'x1.33'x16psf=340
ZONE 3-14'+2'x1.33'x16psf=340

GENERAL NOTE ON CHAPTER 7 WALL COVERINGS

*THERE IS A LOT OF ADDITIONAL CONTENT IN CODE CHAPTER 7 BEYOND THE LIMITED CONCERNS THIS PAGE. R703 IS ABOUT EXTERIOR WALL COVERINGS WHICH INCLUDES WEATHER RESISTANT BARRIERS (WRB) , EXTERIOR CONDENSATION CONTROL, INSULATION, AS WELL AS SIDINGS AND ATTACHMENTS PRESENTED BELOW.

***TABLE 703.3(1) (ABBREVIATED) FASTENING SCHEDULE**_BELOW SHOWS ONLY ONE OF ABOUT 8 SIDING PRODUCTS FOUND IN THE FULL TABLE. INDICATES THE SIDING MATERIAL, THICKNESS OF MATERIAL, WHAT IS RECIEVING THE FASTENERS-AND THE SPACING. SIMPLE ENOUGH. NOTE THIS TABLE SPECIFIES NAIL SHANK DIAMETER **AND** NAIL HEAD SIZE, WHICH IS APPROPRIATE IN THIS CASE GIVEN THE 'SUCTION' LOADING CONDITION ON SIDING. THE NAIL SHANK IS MANAGING THE 'PULL OUT' POTENTIAL FROM ITS NAILING POSITION, THE NAIL HEAD IS KEEPING THE SIDING PRODECY FROM TEARING AWAY FROM THE NAIL.
***STUD SPACING**_16" OC IS THE DEFAULT. NOTE A SINGLE NAIL INTO THE STUD REQUIRED THIS TABLE. SIDING APPLIED TO 24" OC STUD SPACING REQUIRES A MANUFACTURERS FASTENING REPORT.
***OTHER COMMON CONDITIONS**_FASTENING INTO SHEATHING ONLY IS ADDRESSED IN TABLE R703.3.3. FASTENING SIDING, AND OPTIONAL FURRING, THRU RIGID FOAM INSULATION, IS ADDRESSED TABLE R703.15.2 AND TABLE R703.16.1 AND TABLE R703.16.2. SEVERAL OTHER ATTACHMENT CONDITIONS AND PRESCRIPTIONS ARE TOO INCORPORATED IN R703.

TABLE R703.3(1)
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS (inches)	JOINT TREATMENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS: Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud[i]	Direct to studs	Number or spacing of fasteners
Hardboard panel siding (see Section R703.5)	7/16	—	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	6" panel edges 12" inter. sup.d
Hardboard lap siding (see Section R703.5)	7/16	Note e	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	Same as stud spacing 2 per bearing

****30 PSF LIMIT**_THE WIND LIMITATION NOTE 703.3.2 SAYS THAT (ONLY) WHEN C+C PRESSURES EXCEED 30 PSF DO ATTACHMENTS REQUIRE ADDITIONAL INPUT/CONCERN BEYOND THOSE 'STANDARD' FASTENINGS REQUIRED IN TABLE R703.3(1) AND THE REST OF THE SEVERAL 'STANDARD' FASTENING TABLES.
***BEYOND 30 PSF**_IF NAILING/FASTENING NEEDS TO BE HEAVIER DUTY BECAUSE OF EXCEEDING THE 30 PSF RULE IT IS ADVISED TO CHECK THE (SIDING) PRODUCT'S SPECIFICATIONS.
***CHECK THE C+C TABLE FOR BEYOND 30 PSF**_SEE (c8.6). SCANNING THIS TABLE INFORMS THAT THERE ARE NO CONDITIONS IN THE EXPOSURE B, 115 MPH ZONE WHERE THE 30 PSF IS EXCEEDED FOR WALLS. THERE ARE INSTANCES WHERE IN THE HIGHER WIND ZONES WHERE THAT 30 PSF IS EXCEEDED WHERE ENGINEERS ASSISTANCE IS NEEDED REGARDLESS. IF A PROJECT IS IN EXPOSURE C OR D THE ALL VALUES IN TABLE R301.2(2) REQUIRE THE APPROPRIATE ADJUSTMENT MULTIPLIER TO DETERMINE THE WALL ZONE(S) THAT MAY EXCEED THE 30 PSF. THE TABLE BELOW DEFINES AN ADDITIONAL DETERMINANT WHEN HEAVIER DUTY FASTENERS ARE REQUIRED BASED ON WIND SPEED, EXPOSURE CATEGORY, AND MEAN ROOF HT.

R703.3.2 Wind limitations.

Where the design wind pressure exceeds 30 psf or where the limits of Table R703.3.2 are exceeded, the attachment of wall coverings and soffits shall be designed to resist the component and cladding loads specified in Table R301.2(2) for walls, adjusted for height and exposure in accordance with Table R301.2(3). For the determination of wall covering and soffit attachment, component and cladding loads shall be determined using an effective wind area of 10 square feet (0.93 m^2).

TABLE R703.3.2
LIMITS FOR ATTACHMENT PER TABLE R703.3(1)

MAXIMUM MEAN ROOF HEIGHT			
Ultimate Wind Speed (mph 3-second gust)	Exposure B	Exposure C	Exposure D
115	NL	50′	20′
120	NL	30′	DR
130	60′	15′	DR
140	35′	DR	DR

DESIGN REQUIRED

GENERAL NOTE ON CHAPTER 9 ROOF ASSEMBLIES

*SIMILAR TO CHAPTER 7 THIS CHAPTER 9 COVERS A LOT OF GROUND. THE SUBJECT OF THIS CHAPTER c8 IS HOW TO FASTEN DOWN ROOFING SO IT STAYS ON THE ROOF. THIS EXCERPT FROM CHAPTER 9 DISCUSSES SAPHALT SHINGLES, SELECTED BECAUSE OF THEIR PREVALENCE IN RESIDENTIAL ROOFING. CONSISTENT WITH BOTH UPLIFT AND SIDING TREATMENT REQUIREMENTS FOR 115 MPH WIND SPEEEDS REQUIRES CODE STANDARD INSTALLATION ONLY.

R905.2 ASPHALT SHINGLES
R905.3 CLAY+CONCRETE TILE
R905.4 METAL ROOF SHINGLES
R905.5 MINERAL SURFACED ROLL ROOFING
R905.6 SLATE SHINGLES
R905.7 WOOD SHINGLES
R905.8 WOOD SHAKES
R905.10 METAL ROOF PANELS

***OTHER ROOFING MATERIALS**_LISTED AT LEFT ALTERNATIVE RESIDENTIAL ROOFING CHOICES SUBJECT TO BLOW OFF. THE CODE ALSO COVERS A RANGE OF SINGLE PLY MEMBRANE ROOFS AND PHOTOVOLTAIC OPTIONS

About this chapter: *Chapter 9 addresses the design and construction of roof assemblies. A roof assembly includes the roof deck, substrate or thermal barrier, insulation, vapor retarder and roof covering. This chapter provides the requirement for wind resistance of roof coverings. The types of roof covering materials and installation addressed by Chapter 9 are: asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shakes and shingles, built-up roofs, metal roof panels, modified bitumen roofing, thermoset and thermoplastic single-ply roofing, sprayed polyurethane foam roofing, liquid applied coatings and photovoltaic shingles. Chapter 9 also provides requirements for roof drainage, flashing, above-deck thermal insulation, rooftop-mounted photovoltaic systems and recovering or replacing an existing roof covering.*

R905.2.4 Asphalt shingles.

Asphalt shingles shall comply with ASTM D3462.

R905.2.4.1 Wind resistance of asphalt shingles.

Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table R905.2.4.1 for the appropriate ultimate design wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D7158 and the required classification in Table R905.2.4.1.

Exception: Asphalt shingles not included in the scope of ASTM D7158 shall be tested and labeled in accordance with ASTM D3161. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table R905.2.4.1.

TABLE R905.2.4.1
CLASSIFICATION OF ASPHALT ROOF SHINGLES

MAXIMUM ULTIMATE DESIGN WIND SPEED V_{ult} FROM FIGURE R301.2(5)A (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD} FROM TABLE R301.2.1.3 (mph)	ASTM D7158[a] SHINGLE CLASSIFICATION	ASTM D3161 SHINGLE CLASSIFICATION
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G o[illegible]	[illegible]
155	120	G o[illegible]	[illegible]
168	130	H	[illegible]
181	140	H	[illegible]
194	150	H	[illegible]

*SEE R301.2.1.3
*THE SAME WIND WE ARE DESIGNING FOR HAS HAD ITS CATEGORIZATION FORMAT 'UPDATED'. THIS 2018 CODE IS NOW RECOGNIZING THE V_{ULT} CATEGORIZATION FORMAT AS ITS BASE-BUT-THE OLDER V_{ASD} FORMAT WILL HANG AROUND AS SOME TESTINGS AND STANDARDS HAVE BEEN ESTABLISHED USING THAT WIND STANDARD.

For SI: 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a. The standard calculations contained in ASTM D7158 assume Exposure Category B or C and a building height of 6[illegible] ions outside of these assumptions.

*BASELINE FASTENING

R905.2.5 Fasteners.

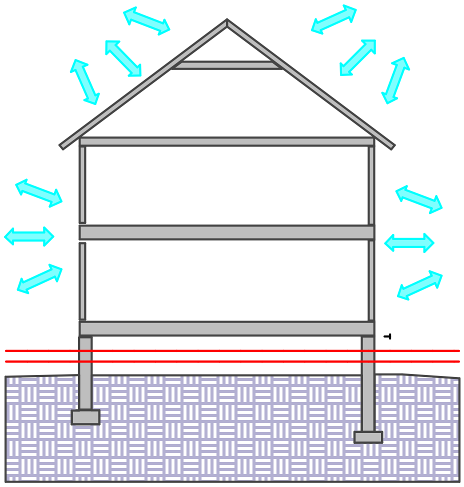
Fasteners for asphalt shingles shall be galvanized steel, stainless steel, aluminum or copper roofing nails, minimum 12-gage [0.105 inch (3 mm)] shank with a minimum 3/8-inch-diameter (9.5 mm) head, complying with ASTM F1667, of a length to penetrate through the roofing materials and not less than 3/4 inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than 3/4 inch (19.1 mm) thick, the fasteners shall penetrate through the sheathing.

R905.2.6 Attachment.

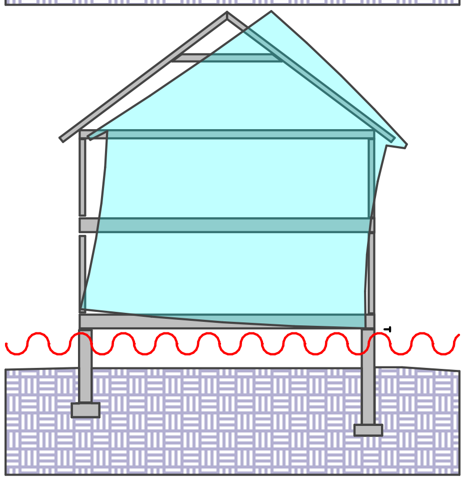
Asphalt shingles shall have the minimum number of fasteners required by the manufacturer's *approved* installation instructions, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12, 175-percent slope), shingles shall be installed in accordance with the manufacturer's *approved* installation instructions.

LATERAL BRACING REQUIRED FOR WIND AND SEISMIC FORCES

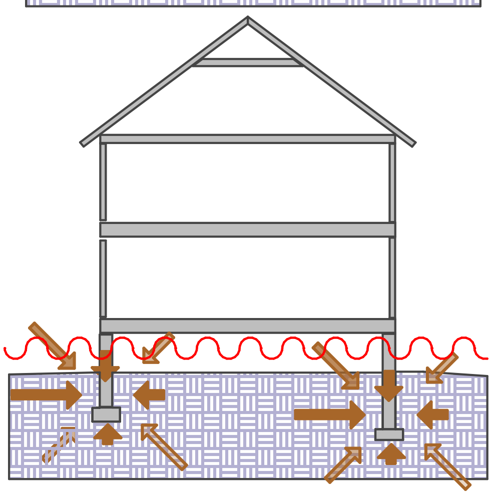
***WIND AND SEISMIC FORCES_**DO HAVE SIMILAR FORCE CONSEQUENCES ON STRUCTURES WHICH FALL INTO THIS CATEGORY OF LATERAL BRACING. THEY ARE DEALT WITH IN THE IRC TOGETHER. WHEN SEISMIC LOADING EXCEEDS WIND LOADING IN 'SEVERITY', IT BECOME THE REQUIRED DESIGN STANDARD, AND VICE VERSA, WHEN WIND LOADING EXCEEDS SEISMIC LOADING IN 'SEVERITY' IT BECOMES THE DESIGN STANDARD. THE MAPS (SHOWING THE EASTERN HALF OF THE USA) HELP ILLUSTRATE THIS.



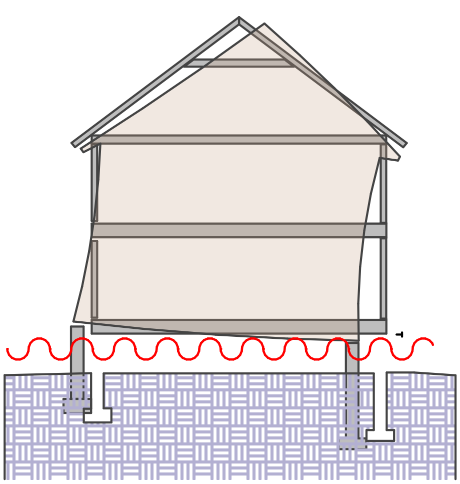
***WIND FORCES_**THEORETICALLY A FOUNDATION IS SOLIDLY FIXED INTO THE EARTH. THE MULTIDIRECTIONAL WIND FORCES ABOVE THE EARTHS SURFACE PUSH AND PULL ON THE STRUCTURE FROM ALL DIRECTIONS. THE MANY COMPONENTS OF THE STRUCTURE WANT IT TO RACK, SLIDE, AND LIFT.



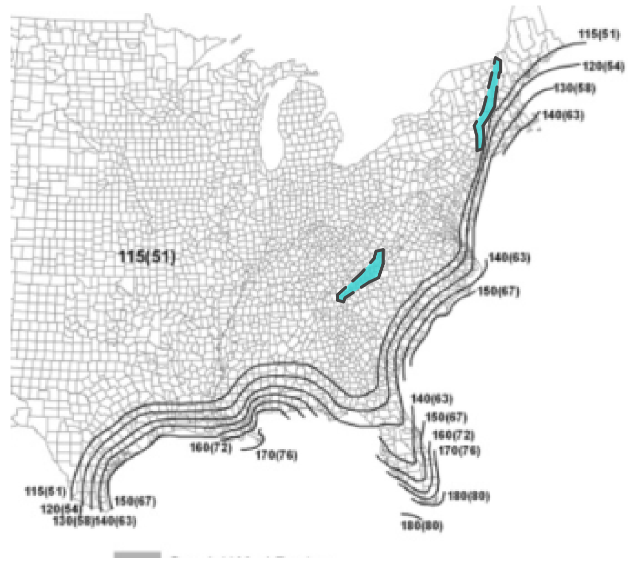
***DEFORMATION_**AS THIS DIAGRAM SUGGESTS CAN EFFECT THE WHOLE INTERCONNECTED STUCTURE- IMPOSSIBLE TO SHOW IN THESE 2D ILLUSTRATIONS IS THAT THIS CAN ESSENTIALLY HAPPEN IN ANY OF THE 360 DEGREES OF ROTATION.



***SEISMIC FORCES_**ARE UNDERGROUND BASED, SO THEY FIRST RATTLE AND RUMBLE THE FOUNDATION. THE STRUCTURE ABOVE IS HAVING ITS SUPPORT DISRUPTED -THE RUG IS BEING PULLED OUT FROM UNDERNEATH. IT SEEMS ODD BUT MAKES SENSE WHEN THINKING THRU IT, THAT THE NET EFFECT ON THAT STRUCTURE ABOVE IS VERY SIMILAR TO WIND LOADING. RACKING/SLIDING/LIFTING BECAUSE MOVEMENT IS UP/DOWN, AND BACK,FORTH



***DEFORMATION_**THE FOUNDATION SHIFTS BECAUSE THE EARTH IS SHIFTING. SIMILAR EFFECTS TO THOSE GENERATED BY THE WIND IN THE DIAGRAM ABOVE



***IRC WIND MAP_**THIS EASTERN HALF OF THE US IS PRETTY STRAIGHTFORWARD. EXCEPTING THE ENTIRE COAST LINE AND 2 SPECIAL WIND ZONES 115 MPH IS THE DESIGN CLASSIFICATION. THE WESTERN HALF OF THE US IS ALSO MOSTLY IN THE 115 MPH CLASSIFICATION EXCEPTING A HANDFUL OF SMALL (MOUNTAINOUS) SPECIAL WIND ZONES.

***MAP COMPARISON_**MOST LOCATIONS HAVE A CLEAR WIND OR SEISMIC PRIMARY CONCERN. THE SOUTH CAROLINA COAST (NEAR CHARLESTON) IS ONE EXCEPTION WHRE BOTH WIND AND SEISMIC CONCERNS EXIST.

***SEISMIC CATAGORIES_**ARE 'GRADED' FOR SEVERITY BY CATEGORY- AS ARE MOST OF MOTHER NATURE'S MOOD FITS. A,B,C ARE PRETTY BENIGN, DO NOT REQUIRE SPECIAL ATTENTION, AND ANY IRC REQUIRED BRACING DESIGN SHOULD BE WIND BASED. CATEGORIES D0, D1, D2 MAY REQUIRE SPECIFIC ATTENTION, AND MAY TAKE PRECEDENCE OVER WIND DESIGN REQUIREMENTS. THE CODE IS WANTING TO DEFINE THE WORST LOAD CASE AND HAVE US PREPARE FOR IT.

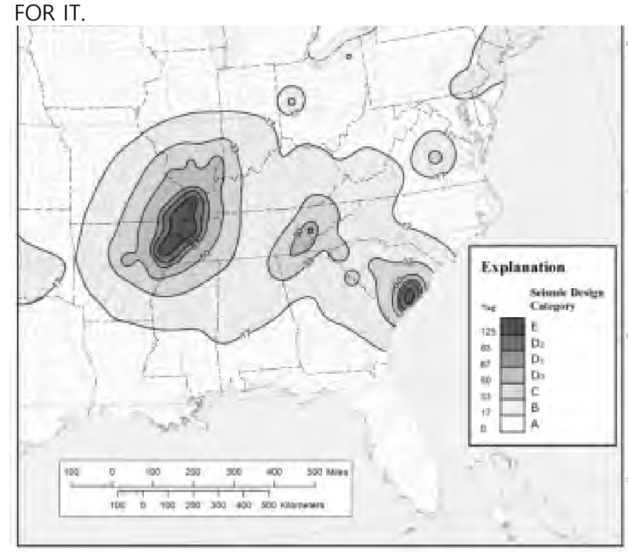
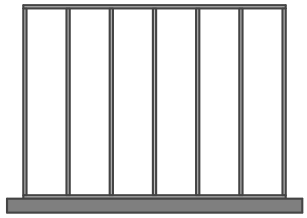


FIGURE R301.2(2)
SEISMIC DESIGN CATEGORIES

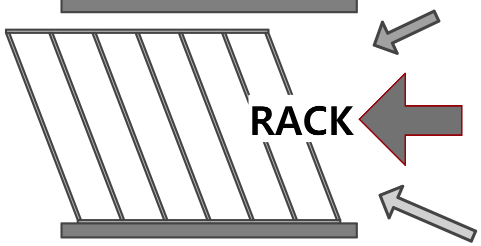
LATERAL BRACING REQUIIRED FOR RACK, SLIDE, LIFT

RACK, SLIDE, LIFT EFFECTING THE WALL

THE BASIC FRAME WALL
*MADE OF INDIVIDUAL STUDS, CONNECTED WITH TOP AND BOTTOM PLATES AND NAILS. WHEN LEFT ON THEIR OWN NOT A VERY EFFECTIVE STRUCTURAL PACKAGE.

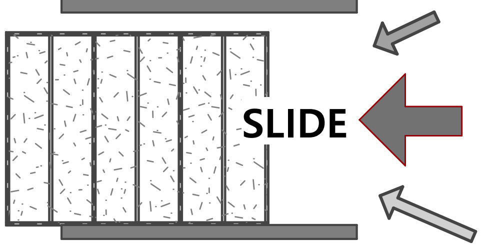


WEAKNESS 1 RACKING
*PUSH LATERALLY ON THAT WALL AND IT WILL COLLAPSE. WITH A LOT OF HOUSE WEIGHT ABOVE IT IT WILL COLLAPSE DRAMATICALLY.



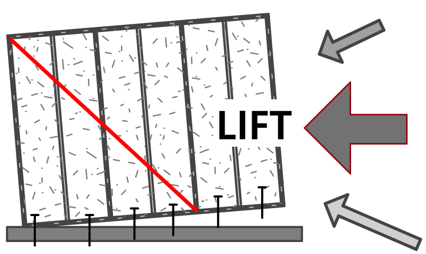
PREVENT THE RACKING
*SHEETGOODS NAILED ON ONE OR BOTH SIDES PREVENTS THAT RACKING COLLAPSE.
*SO WILL LET IN WOOD OR STEEL BRACING WHEN LOCATED CORRECTLY.

WEAKNESS 2-SLIDING
*PUSH LATERALLY ON THAT WALL AND IT CAN SLIDE. BOTH RACKING AND SLIDING CAN HAPPEN IF NEITHER HAS INCORPORATED A RESTRAINT METHOD.

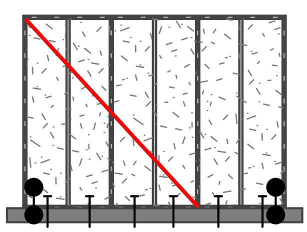


PREVENT THE SLIDING
*SECURE THE WALL TO FLOOR (AND CEILING)
*NAILING IS THE STANDARD. THAT LATERAL PUSH IS A 'SHEAR' FORCE ON THOSE FASTENERS.

WEAKNESS 3-LIFT
*IF THE WALL CAN NO LONGER RACK, CAN NO LONGER SLIDE, THE LATERAL FORCE WILL WANT TO LIFT-OVERTURN THAT WALL.
*SO IT NEEDS TO BE HELD DOWN.
*THE (SHEAR) NAILS THAT PROVIDE SLIDING PROTECTION ARE ASKED TO PERFORM A WITHDRAWAL RESISTANCE WHICH THEY MAY BE INADEQUATE FOR.



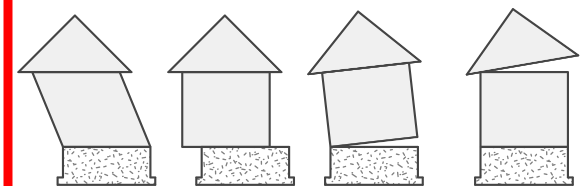
PREVENT THE LIFT 1
*A HOLDOWN DEVICE MAY BE EMPLOYED. IT IS A MECHANICAL CONNECTION BETWEEN WALL AND FLOOR, AND OR FOUNDATION. HOW HEAVY DUTY IS BASED ON THE FORCE. COULD BE A SIMPLE CLIP, A FORMIDABLE STRAP, OR A CONNECTING HOLD DOWN 'SYSTEM'.



PREVENT THE LIFT 2
*A SHEATHING PRODUCT CAN BRIDGE CONNECT ROOF TO WALL TO FLOOR TO FOUNDATION. MAKES A NICE SECURE INTERCONNECTED WHOLE WHEN NAILED CORRECTLY. OSB IS TYPICALLY THE FAVORED MATERIAL. IT HAS SHEAR RESISTANCE CAPACITY USUALLY BETTER THAN PLYWOOD AND FIBERBOARDS.

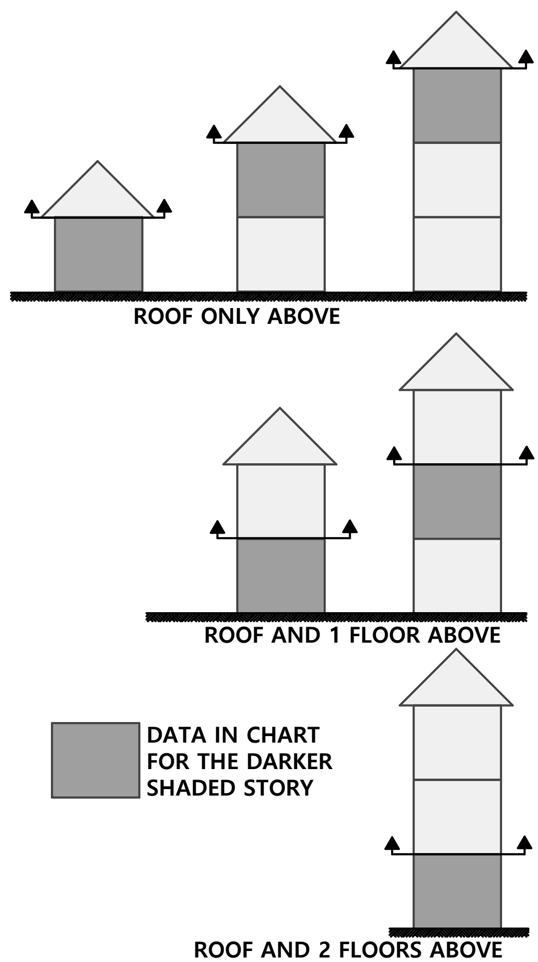
RACK, SLIDE, LIFT EFFECTING THE WHOLE

*THE INTENT OF WALL BRACING IS TO PREVENT ANY OF THE BELOW DISPLACEMENTS FROM HAPPENING. MAKING THE WALLS RIGID AND ATTACHING THEM ADEQUATELY TO CONSTRUCTION ABOVE AND BELOW WILL ACCOMPLISH THIS. THIS WHOLE WALL BRACING ADVENTURE IS ABOUT DETERMINING HOW RIGID AND HOW WELL CONNECTED THE WALLS NEED TO BE.



STORY (SYMBOLS) AND LOADING

***FOR GRAVITY LOADING** SYMBOLS BELOW ARE USED IN SEVERAL PRESCRIPTIVE FRAMING CHARTS. FOR GRAVITY LOADING THESE FLOOR DESIGNATIONS ARE ADDRESSING INCREASED LOADING AS A CONDITION OF HOW MUCH THEY ARE SUPPORTING ABOVE.
***FOR WIND AND SEISMIC LOADING** LOADING IS SIMILARLY INCREASED ON WALLS SUPPORTING MORE LOAD ABOVE. FOR LATERAL BRACING THAT INCREASED LOAD ABOVE BECOMES A GREATER MOVEMENT/SWAYING LIABILITY AND NEEDS THERFORE TO BE MORE RIGIDLY HELD IN PLACE.



LATERAL BRACING OCCUPIES A UNIQUE SPOT IN THE CODE

*MOST CODE COMPLIANCE ITEMS IN THE ESSENTIALLY PRESCRIPTIVE IRC CODE REQUIRE LOOKING, CHECKING, (MAYBE INTERPOLATING), AND CONFIRMING A SELECTION THAT MEETS PROJECT DEMANDS. THE WALL BRACING COMPLIANCE DEMANDS A BIT MORE. THE WALL BRACING CONDITIONS AND CRITERION SET FIRST NEED UNDERSTANDING, THEN WALL BRACING MINIMUMS SELECTED AND SIZED. THEN PROPERLY PLACED ON A COMPLIANCE DRAWING. THESE MINIMUMS MAY NOT 'FIT'- REQUIRING RE-SELECTION AND RE-DESIGN. WINDOWS AND DOORS MAY NEED RELOCATION TO ALLOW THIS TO PASS BRACING DIMENSIONAL CONDITIONS. THERE IS A COMPLICATION TO THIS. ENOUGH OF A COMPLICATION THAT WHEN THESE REQUIREMENTS FIRST APPEARED IN THE CODE, A COTTAGE INDUSTRY OF BOOKLETS AND SEMINARS SPRANG UP TO HELP EXPLAIN IT ALL TO CODE OFFICIALS, BUILDERS, AND DESIGN PROFESSIONALS.

2 METHODS

*THE STANDARD METHOD IS THE MORE COMPLICATED. AND THE MORE FLEXIBLE. THE SIMPLIFIED METHOD HAS 8 PREREQUISITES FOR ELIGIBILITY, IS LESS FLEXIBLE, BUT IS SIMPLER. BOTH ARE MEANS TO QUANTIFYING AND POSITIONING WALL BRACING DESIGNED TO KEEP A STRUCTURE STABLE UNDER WIND AND SEISMIC FORCES IN BOTH THE X AN Y DIRECTIONS.

METHODS SELECTION

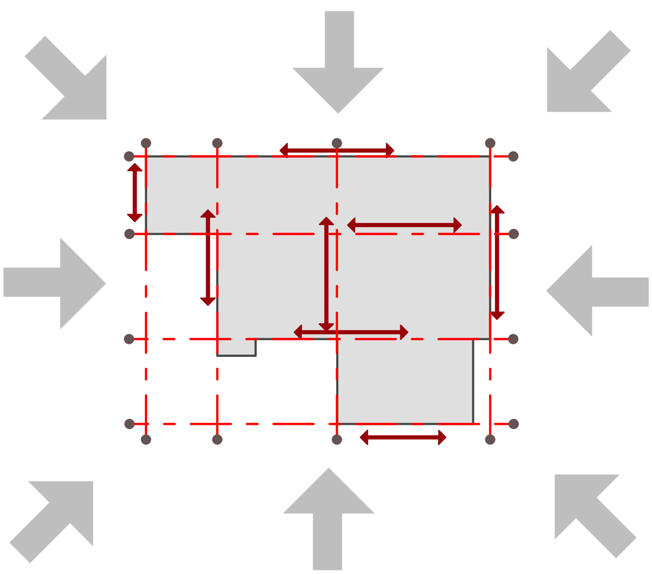
*CHECK FIRST WITH LOCAL CODE TO FIND IF BOTH OPTIONS ARE AVAILABLE. EACH STATE HAS ITS OWN EDITED VERSION OF THE CODE AND SOME HAVE ELECTED TO ELIMINATE THE SIMPLIFIED VERSION****. IF THE SIMPLIFIED VERSION IS VIABLE THEN CHECK THE PREREQUISITES TO DETERMINE IF THE PROJECT IS ELIGIBLE. IF BOTH OPTIONS REMAIN OPEN AND THE PROJECT IS A ONE TIMER THEN THE SIMPLIFIED VERSION WILL REDUCE HEADACHES. FOR DESIGNERS, BUILDERS AND ARCHITECTS WHO ARE RETURNING TO THESE REQUIRMENTS EVERY PROJECT THEN THE STANDARD METHOD IS THE SMARTER ONE TO LEARN, AND INVEST THE TIME TO SET UP A WORKING TEMPLATE FOR. THE MORE PROJECTS UNDER BELT THE EASIER THIS GETS.

THE WAKE UP CALL+BACKGROUND

*SEEMS LIKE BIG CHANGES IN OUR CONTEMPORARY WORLD THAT INVOLVE IMPROVEMENTS TO ESSENTIALLY BAD BEHAVIOR WE ARE ALL AWARE OF INVOLVE THE A BIG EVENT THAT WAKES EVERYONE UP.

*ONE SUCH EVENT WAS HURRICANE ANDREW IN SOUTHERN FLORIDA IN 1992 CAUSING A LEVEL OF DAMAGE THAT WOKE UP THE BUILDING INDUSTRY AND THE PUBLIC TO THE POWER OF THE WIND RELATIVE TO HOME BUILDING AND HUMAN SAFETY. CODE REQUIREMENTS, PERMITTING AND INSPECTIONS WERE FORCED TO EMERGE FROM A LONG AND LAZY HIBERNATION. THE WORLD OF INSURANCE AND LIABILITY WAS SHAKEN, AND THE ENGINEERS SHARPENED THEIR UNDERSTANDING OF WIND FORCES APPLICABLE TO SMALL SCALE RESIDENTIAL CONSTRUCTION. THESE WALL BRACING REQUIREMENTS EVOLVED.

*THESE WALL BRACING REQUIREMENTS HAVE HAD A TOUGH CHILDHOOD. BUILDING COSTS, LOCAL WIND RELAVANCE, COMPLICATION IN CIPHERING COMPLIANCE, ALL EFFECTED VARYING DISPOSITIONS ABOUT THE BRACING REQUIREMENTS. BOTTOM LINE IS THEY ARE HERE TO STAY AND LOCAL PERMIT AND INSPECTIONS DEPARTMENTS ARE COMING MORE AND MORE TO DEMAND PROPER COMPLIANCE.



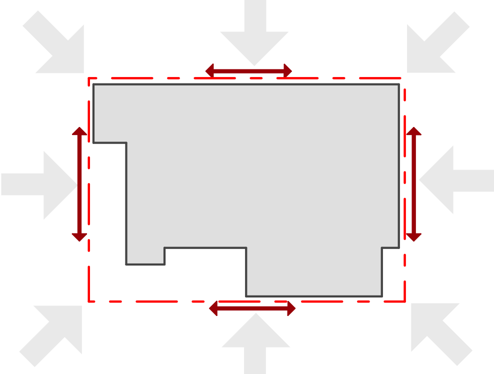
WALL BRACING R602.10

***INTENT**_TO FIND A WAY TO ADDRESS ALL PROJECTS. WALL CONSTRUCTION, BRACING 'METHOD', #OF STORIES, EXPOSURE CATEGORY, WIND ZONE, SEISMIC ZONE., ARE ALL VARIABLES THAT REQUIRE INCLUSION IN THE SOLUTION.

***PREMISE**_BRACING 'LINES' ARE ESTABLISHED IN BOTH X AND Y DIRECTION MORE OR LESS FOLLOWING EXTERIOR WALL LINES, AND INTERIOR WALL LINES (WHEN NEEDED). METHODS OF BRACING ARE SELECTED. LENGTHS FOR THOSE METHODS ARE CODE CHART DETERMINED. THOSE BRACING LENGTHS AND TYPES ARE PLAN POSITIONED IN ACCORDANCE WITH CODE RESTRICTIONS. ULTIMATELY ADEQUATE BRACING IN THE X AND Y DIRECTIONS ARE ACHIEVED.

***THE DIFFICULTIES ARISE FROM FLEXIBILITY**_THE MANY CHOICES AVAILABLE, AND SPECIFIC PROJECT CONDITIONS INCREASE CHOICES. IT IS SUGGESTED THAT ONE HAVE A GO USING THE CODES GUIDANCE AND THEN DECIDE

***OTHER BETTER RESOURCES**_THIS PROJECT DECIDED NOT TO ATTEMPT A WALK THRU OF THIS STANDARD WALL BRACING PROCESS. PLENTY OF RESOURCES THAT HAVE THE SPACE TO MAKE A COMPLETE PRESENTATION ARE OUT THERE AND SEARCHABLE. ONE COMPLETE AND 'OFFICIAL' GUIDE IS CALLED **2018 IRC WOOD WALL BRACING PROVISIONS** AND HAS BEEN PRODUCED BY THE CODE COUNCIL AND THE ENGINEERED WOOD PRODUCTS ASSOCIATION (ICC AND APA). BE PREPARED AS IT IS 275 PAGES.



SIMPLIFIED WALL BRACING R602.12

***LIMITATIONS**_60' X 60' MAX FOOTPRINT, WALL CONSTRUCTION MUST BE CS (CONTINUOUS SHEATHING), 3 STORY MAX, WIND ZONE LIMITED TO 130 MPH, SEISMIC ZONES A,B,C ONLY, ROOF EAVE TO RIDGE HT 15' OR LESS. PLUS A FEW.

***PREMISE**_THE FOOTPRINT IS CIRCUMSCRIBED INSIDE A SINGLE RECTANGLE. THE EXTERIOR WALLS FACING EACH SIDE OF THAT RECTANGLE GET ASSIGNED AN APPROPRIATE QUANTITY OF 'BRACING UNITS'. THESE BRACING UNITS REPRESENT 3 LIN FEET OF FULLY SHEATHED WALL.

***ONE GOOD VARIABLE**_THE NARROWER(LESS THAN 3') PORTAL FRAME IS AVAILABLE AS A WORKAROUND. IT CAN COME IN HANDY FOR PROJECTS WITH GENEROUS DOOR AND WINDOW OPENINGS.

***SEE OVERVIEW SAMPLE PROJECT**_NEXT SHEET OFFERS A PRETTY QUICK OVERVIEW OF THE SIMPLIFIED METHOD. THE STANDRD METHOD IS SIMILARLY HEADED TOWARD ESTABLISHING QUALIFIED BRACING LENGTHS. IT JUST TAKES A MORE TWISTS AND TURNS GETTING THERE.

STATE OPTIONS****

*_NORTH CAROLINA, FOR EXAMPLE, HAS EVOLVED A SINGLE HYBRID METHOD THAT USES THE CIRCUMSCRIBED RECTANGLE OR MULTIPLE RECTANGLES AS BEST SUITS A HOME DESIGNS FOOTPRINT GEOMETRY. A DIFFERENT BUT SIMILAR SEQUENCE QUANTIFYING AND POSITIONING THE ADEQUATE LINEAL FOOTAGE OF BRACING.

TABLE R602.12.4

MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE

ULTIMATE DESIGN WIND SPEED (mph)	STORY LEVEL	EAVE-TO-RIDGE HEIGHT (feet)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE[a, b, d]						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE[a, b, d]					
			Length of short side (feet)[c]						Length of long side (feet)[c]					
			10	20	30	40	50	60	10	20	30	40	50	60
					2	2	3	3	1	2	2	2	3	3
		10	2	3	3	4	5	6	2	3	3	4	5	6
115			2	3	4	6						6	7	8
			1	2	3	3						3	4	4
				3	4	5						5	6	7
			2	4	5	6						6	7	9

*AT FIRST GLACE THIS LONG SIDE/SHORT SIDE MAY SEEM CONTRADICTORY. REMEMBER THE LONG SIDE RECIEVES MORE WIND PRESSURE SO IT IS THE SHORT SIDES THAT NEED MORE WALL BRACING RESISTANCE.

*SISTER CHART BELOW IN THE CODE FOR 130 MPH

*ROOF ONLY ABOVE

*1 FLOOR+ROOF ABOVE

*ON THE LONG 50' SIDE THE UPPER FLOOR REQUIRES 3 (3') UNITS OR 9 LIN FT TOTAL

*ON THE LONG 50' SIDE THE MAIN FLOOR REQUIRES 4 (3') UNITS OR 12 LIN FT TOTAL

*ON THE SHORT 30' SIDE THE UPPER FLOOR REQUIRES 4 (3') UNITS OR 12 LIN FT TOTAL

*ON THE SHORT 30' SIDE THE MAIN FLOOR REQUIRES 6 (3') UNITS OR 18 LIN FT TOTAL

*THE 3' BRACING UNITS POSITIONED ALONG THESE WALLS HAVE TO FOLLOW LIMITATIONS PER R602.12.5 ONLY.

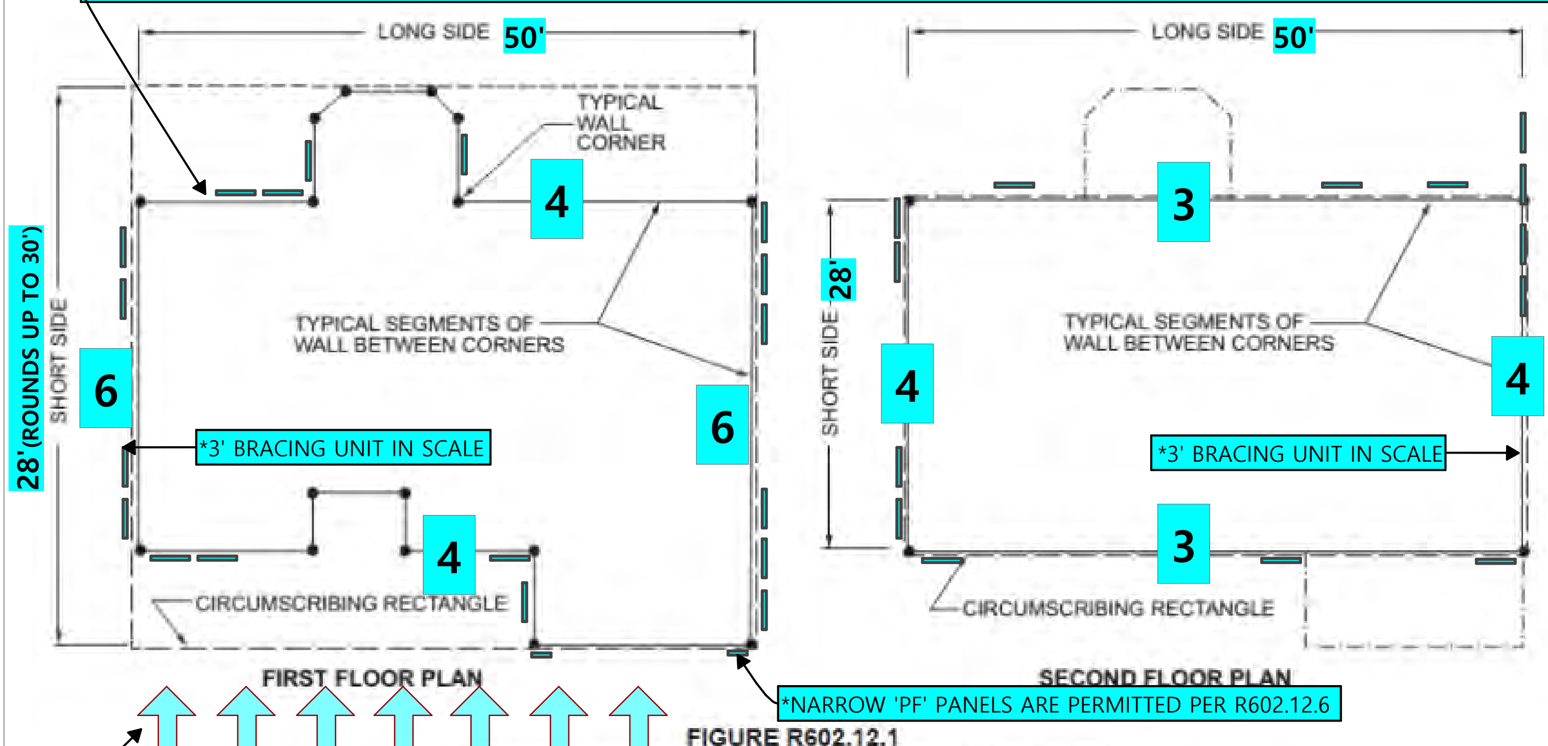


FIGURE R602.12.1

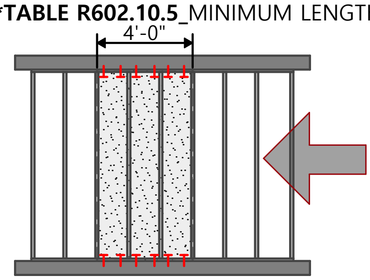
RECTANGLE CIRCUMSCRIBING AN ENCLOSED BUILDING

*MORE SURFACE AREA AND THERFORE PRESSURE ON THE LONG WALLS, HENCE THE SHORT WALLS REQUIRE MORE BRACING RESISTANCE.

SIMPLIFIED WALL BRACING IS WELL EXPLAINED IN THIS 2009 POWER POINT LIKELY PRESENTED TO CODE ENFORCEMENT OFFICERS AND BUILDERS
http://www.spotsylvania.va.us/filestorage/21027/21029/21583/21773/2009_IRC_Simplified_Wall_Bracing_0212.pdf

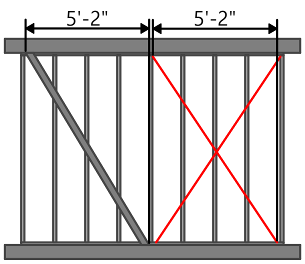
WALL BRACING TYPES CATAGORIRIZED BY STRUCTURE

***TABLE R602.10.4_**BRACING METHODS
***TABLE R602.10.5_**MINIMUM LENGTH OF BRACED WALL PANELS



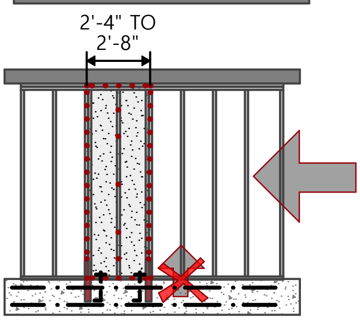
RESISTANCE WITH 'FULL WIDTH' BRACING

***GENERAL_**THE MATERIAL AND ITS FASTENERS NEED TO GRAB ONTO THE STUDS AND BECOME CAPABLE OF RESISTING RACKING. LENGTH OF ATTACHMENT TO THE FLOOR IS NEEDED TO RESIST THE LIFT. BOTH REQUIRED TO QUALIFY AS VALID BRACING.
***METHODS_**QUITE A FEW. SEE THE LIST OR CHECK TABLE R602.10.4 FOR METHODS, AND R602.5 FOR MINIMUM WIDTHS (AND UNFORTUNATELY A MYRIAD OF CONDITIONS AND OPTIONS).



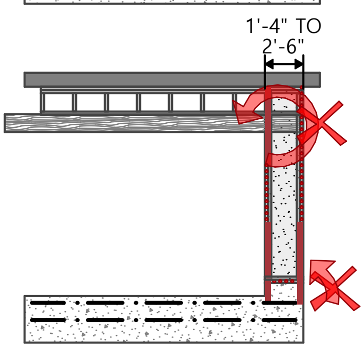
RESISTANCE WITH 'CROSS' BRACING

***GENERAL_**CROSS BRACING IS A TECHNIQUE USED IN MANY CONSTUCTION SITUATIONS TO MAKE (MORE) RIGID TORSIONALLY A RECTANULAR CONSTRUCTION. SINGLE DIRECTION OR 'X' OR 'V' DUAL DIRECTIONS WILL BE REQUIRED BASED ON THE LET IN BRACING MATERIAL. 1X4 WOOD IS AN OLD STANDARD THAT MUST BE TIGHTLY FIT AND INSTALLED. METAL 'L' OR 'T' SECTIONS ARE CUT INTO STUDS. BOTH ARE ONE DIRECTION INSTALLATIONS. METAL (STRAP LIKE) SURFACE NAILED BRACING WILL REQUIRE "X' OR 'V' INSTALLATIONS TO ALLOW BRACING BOTH DIRECTIONS.
***METHODS_LIB** OR LET IN BRACING.



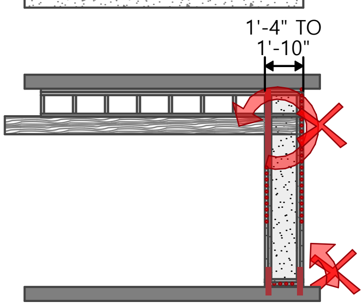
RESISTANCE WITH 'NARROW' BRACING

***GENERAL_**NARROW BRACING IS ASKED TO MANAGE THE SAME LOAD AS ABOVE. SO THE RACKING RESISTANCE MUST BE CONCENTRATED. STRUCTURAL SHEATHNG REQUIRED, AND NAILING IS MORE SERIOUS. AND HOLD DOWN DEVICES REQUIRED TO MORE AGGRESSIVELY MANAGE THE LIFT.**AND HOLD DOWNS NEED TO BE INTO A CONCRETE SLAB/FOUNDATION.
***METHODS_ABW** OR ALTERNATE BRACED WALL PANEL. FIGURE R602.10.6.1



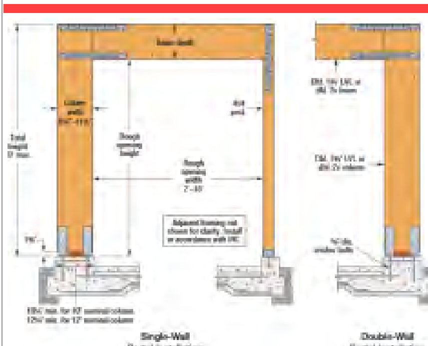
RESISTANCE WITH 'PORTAL FRAME' GARAGE BRACING

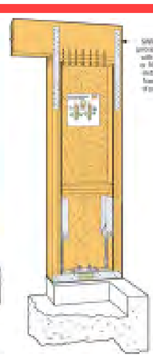
***GENERAL_**THIS TECHNIQUE OF CREATING BRACING ON VERY NARROW WALLS NEXT TO BIG (UNBRACED) OPENINGS EVOLVED QUICKLY TO ADDRESS THE GARAGE DOOR ISSUE,- WHICH COULD NOT BE PROPERLY MANAGED WITH MORE TYPICAL IN LINE WALL BRACING BECAUSE OF LIMITED IN LINE BRACING LENGTHS POSSIBLE AND THE LARGE DOOR OPENINGS. STRUCTURAL SHEATHING AND SPECIFIC NAILING- AND HOLD DOWNS REQUIRED TO MANAGE THE LIFT. THE RACKING LOAD REALLY GETS CONCENTRATED WHERE THE HEADER MEETS THE NARROW PANEL SO A 'FIXED' JOINT BECOMES NECESSARY.
***METHOD PFH_**PORTAL FRAME WITH HOLD-DOWNS FIGURE R602.10.6.2
(HOLDOWNS + VALID IN SEISMIC D_0,D_1,D_2
***METHOD PFG_**PORTAL FRAME AT GARAGE FIGURE R602.10.6.3
(NO HOLD-DOWNS + VALID IN SEISMIC A,B,C ONLY)



RESISTANCE WITH 'PORTAL FRAME' BRACING

***GENERAL_**STRUCTURAL CONCERNS ARE THE SAME AS ABOVE. UPLIFT AND RACKING NEED CONCENTRATED CONTROL. THIS SPECIFIC METHOD CAN BE APLLIED TO BOTH GARAGE DOOR OPENINGS WITH MASONRY UNDERFOOT, AND LARGE WINDOW OPENINGS ON FRAME FLOORS. UPLIFT OPTIONS INCLUDE MODERATE DUTY HOLD-DOWNS OR RIGOROUS SHEATHING ATTACHMENT AT THE WOOD FRAME FLOOR. SEE NOTE (c8.15)
***METHOD CS-PF_**CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION FIGURE R602.10.6.3





RESISTANCE WITH 'PACKAGED/ENGINEERED' BRACING

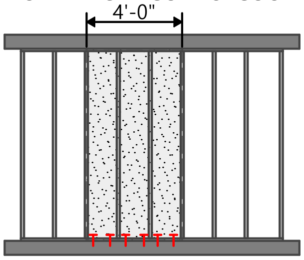
***GENERAL_**3 DIFFERENT APPROACHES ARE SHOWN AT LEFT. FAR LEFT IS A SIMPLE PARTS SYSTEM INTENDED TO FINANCIALLY COMPETE WITH THE CODE SPECIFIED FIELD INSTALLEDMETHODS. THE MIDDLE IMAGE IS A 'SHEAR' BRACED WALL OF WHICH THERE ARE A HANDFUL OF CHOICES DESIGNED FOR DIFFERENT CONDITIONS/LOADS. AT RIGHT IS A PRE-PACKAGED STEEL RIGID OR 'MOMENT' PORTAL FRAME. IN ALL THREE EXAMPLES THE DESIGN INTENT IS THE SAME. PREVENT RACKING AND UPLIFT. THESE ARE ALL SIMPSON PRODUCTS.

COMMENTS ON WALL BRACING OPTIONS

INTERMITTANT BRACING METHODS TABLE R602.10.4

***CODE OPTIONS**_FOR INTERMITTANT BRACING LISTS 9 CONSTRUCTION OPTIONS. THIS REDUCED SUMMARY ONLY MENTIONS 'MAINSTREAM' OPTIONS. THE IDEA AND PROCESS REMAINS THE SAME REGARDLESS OF

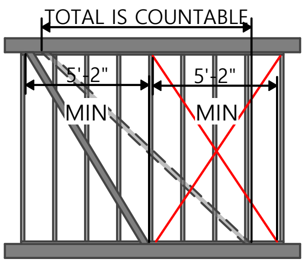
***COUNTING**_QUALIFIED BRACING PANELS HAVE MINIMUM LENGTHS. ANY ADDITIONAL 'LENGTH' BEFORE ENCOUNTERING A CORNER OR OPENING BECOMES 'COUNTABLE' WHEN TOTALING BRACING ALONG A BRACING LINE.



WSP WOOD STRUCTURAL PANELS

***IDEA**_THE WOOD PANEL (OSB IS THE COMMON CHOICE) IS EASY TO APPLY AND NAIL, AND HAS FLEXIBILITY IN PANEL LEGTHS. OFTEN USED WHERE NEEDED TO MEET BRACING REQUIREMENTS WITH AN ALTERNATE SHEATHING FOR THE BALANCE OF THE SURFACE- WHICH COULD BE 1/2" RIGID INSULATION OR ANOTHER CHEAPER SHEETGOOD.

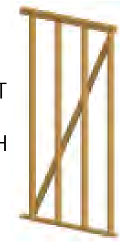
***CONDITIONS**_4' WIDE IS THE DEFAULT REQUIRED WIDTH BUT MUST READ THIS TABLE'S FOOTNOTES FOR CONDITIONS WHERE NARROWER WIDTH'S ARE ACCEPTABLE.



LIB LET IN BRACING

***THE GOOD**_LET IN BRACING IS THE WAY TO GENERATE WALL BRACING 'FLUSH' WITH THE FRAME WALL. THIS PERMITS EXTERIOR RIGID INSULATION TO THEN BE CLEANLY APPLIED OUTSIDE GENERATING A TIGHT THERMAL WRAP.

***THE CONCERN**_IS, SIMPLY SAID, GETTING THE BRACING LENGTHS AND TOTAL BRACING REQUIRED. BOTH METAL STAPS AND WOOD 1X LET IN FORMATS HAVE THEIR OWN LIMITATIONS. HIGHER WIND ZONES AND SEISMIC ZONES ARE



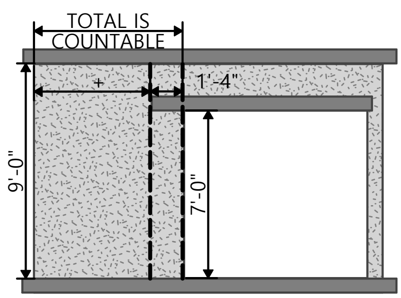
GB GYPSUM WALL BOARD

***IDEA**_WHEN WALL BRACING LINES RUN THRU INTERIORS THOSE INTERIOR PARTITIONS CAN CONTRIBUTE TO BRACING. WITH SHEETROCK ON **BOTH** SIDES THE PARTITION THE MINIMUM WALL LENGTH IS 4'. GB BRACING WALLS WITH SHEETROCK ONE SIDE ONLY REQUIRE 8' TO QUAIFY AS A BRACING PANEL.

***WHEN USED**_NOT UNCOMMON TO ATTEMPT FIRST TO USE EXTERIOR WALLS (ONLY) AS THE BRACNG LINES. IF ADEQUATE BRACING CANNOT BE REALIZED THEN ADDITIONAL BRACING LINES CUTTING THRU THE INTERIOR MAY BE EMPLOYED AND FIND BRACING VALUE IN THOSE SHEETROCK WALLS.

CONTINUOUS SHEATHING HAS SOME PERKS

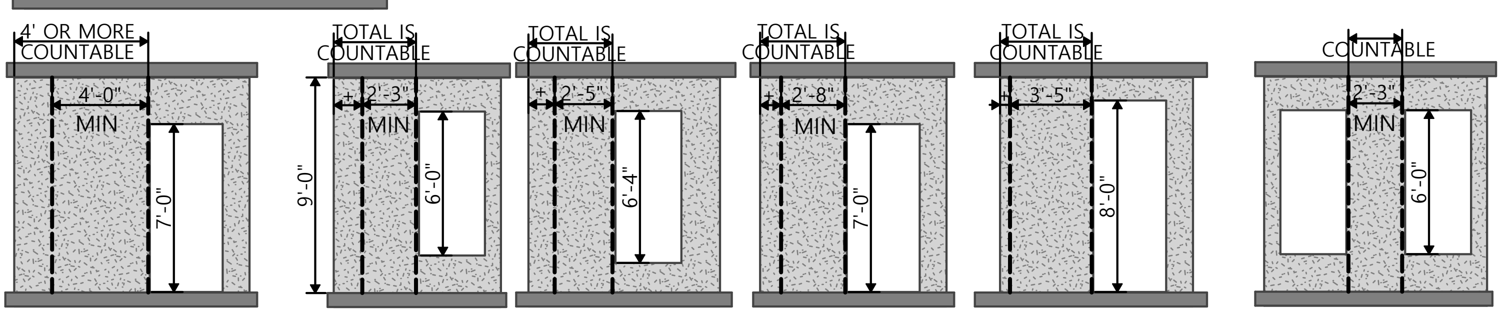
***TOTAL SHELL**_WHERE AS ANY INTERMITTANT BRACING METHOD RELIES ON STRATEGICALLY PLACED RESISTING WALLS, THE CONTINUOUSLY SHEATHED METHOD HAS ALL THE WALLS, INFACT THE WHOLE EXTERIOR FRAMED FACE, AS A RESISTIVE ENTITY. FROM A STRUCTURAL STANDPOINT IT IS INHERENTLY BETTER. BECAUSE IT IS 'COMPLETE' IT GETS SOME RELIEF IN BRACING OPTIONS AND BRACING COUNTS.



THE CS-PF PORTAL FRAME

***DIFFERENT APPLICATIONS**_THE CS PORTAL FRAME CAN BE USED IN GARAGE DOOR OPENING APPLICATIONS, AND LARGE OPENING APPLICATIONS (LIKE 12' OR 16' OR LARGER SLIDING/FOLDING GLASS DOORS ON WOOD FRAME FLOORS. THE BRACING POTENTIAL MAY OR MAY NOT BE REQUIRED BASED ON THE WHOLE BRACING SCHEME. BUT KNOWING THERE IS A FIELD BUILT WAY TO MAKE A LARGELY GLASS FRAME WALL RIGID IS HELPFUL. SOMETIMES THESE BIG GLASS OPENINGS WITHOUT ANY WALL TO WORK WITH NEED CUSTOM STEEL RIGID FRAME HEADER CONFIGURATIONS TO CONTROL RACKING.

***TIEING IN THE HEADER**_ALL THE PORTAL FRAME DESIGNS IN THE CODE ACHIEVE A KIND OF FIXED CONNECTION BY SECURING THE HEADER INTO THE WALL. THIS ADDRESSES THE RACKING RESISTANCE REQUIRED.



NOT RELAVENT WITH MIN 4' | INCREASE THE BRACING WALL LENGTHS IF THESE MINIMUMS ARE MET | BETWEEN WINDOWS

CS NARROWER MINIMUMS POSSIBLE (ONLY) WITH CONTINUOUS SHEATHING (ADJACENT TO DOOR+WINDOW OPENINGS)

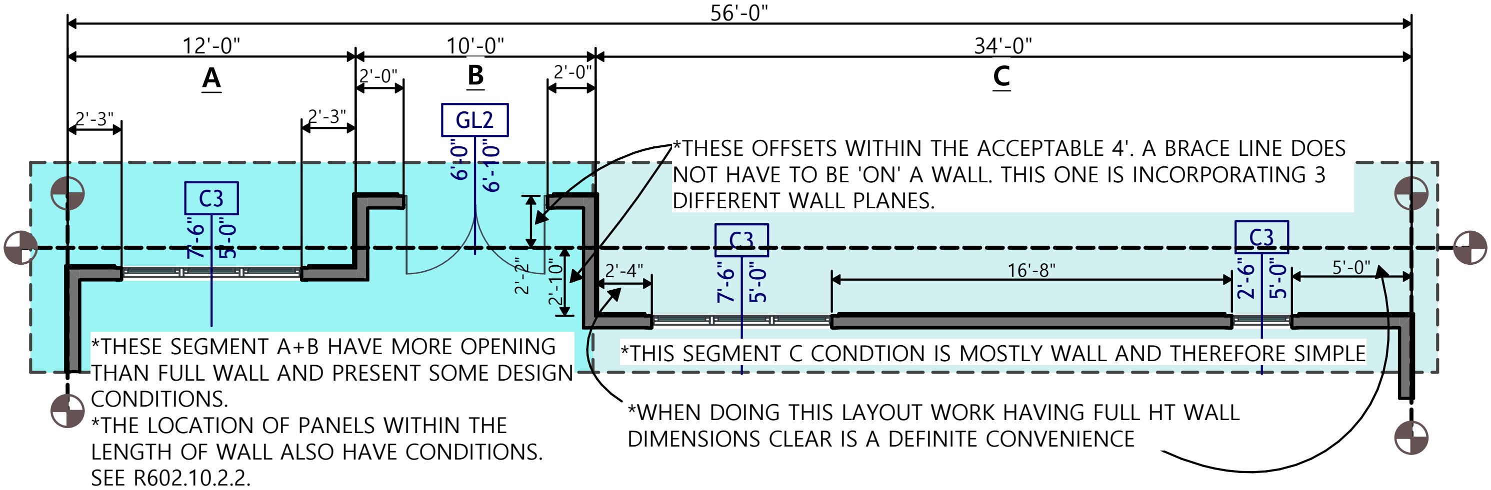
***TABLE R602.10.5**_THE CS-WSP AND CS-SFB METHODS HAVE A 'SLIDING' CHART THAT CAN BE USEFUL IN ACCRUING WALL BRACING VALUE WITH CONTINUOUSLY SHEATHED PROJECTS. 8-12 FT HIGH WALLS ARE ELEIGIBLE. 9' HIGH WALLS SHOW THIS EXTRACTION. THE IDEA IS THAT WHEN CONTINUOUSLY SHEATHED THERE IS VALUE IN THE SHEATHING ABOVE DOORS AND WINDOWS AND BELOW WINDOWS. THIS ALLOWS A REDUCTION IN WIDTH FROM THE NOMINAL BASELINE 4' TO COUNT/BE INCLUDED IN THE WALL BRACING TOTALS. THE MIN COUNTABLE WIDTHS FOR A FEW OF THE OPENING HTS SHOW ABOVE AS EXAMPLES.

***THE COUNT**_IF AT AN INSIDE OR OUTSIDE CORNER, OR BETWEEN OPENINGS, IF THE MINIMUNM WIDTHS SHOWN ABOVE ARE MET THEN THE TOTAL TO THAT INSIDE OR OUTSIDE CORNER OR BETWEEN WINDOWS WILL COUNT. IF THAT DIMENSION IS 4' OR GREATER THEN THIS MINIMUM DIMENSION IS NOT RELAVENT AS THE WALL CAN COUNT ANYWAY.

THIS PARTIAL PRESENTATION LIMITED TO EXPLAINING 'COUNTING' BRACING PANEL LENGTH

***SEARCHING FOR FULL HT WALLS**_WALL BRACING NEEDS FULL HT (FLOOR TO FLOOR) WALLS THAT ARE WITHOUT DOOR+WINDOW INTERUPTIONS. DIFFERENT WALL BRACING CONSTRUCTION METHODS REQUIRE DIFFERING LENGTHS OF FULL HT WALL TO SATISFY A REQUIRED RESISTANCE. THE DESIGN CHALLENGE IS FINDING ADEQUATE FULL HT WALLS THAT ARE POSITIONED TO DO THE JOB.
***THIS 2 PAGE SAMPLE**_IS FOCUSED ON 1 BRACED LINE ONLY. IT FIRST FINDS THE REQUIREMENTS, THEN CONSIDERS THE METHODS AND OPTIONS AVAILABLE.
***OBSERVATION**_DOOR AND WINDOW OPENINGS DISPLACE SOLID WALL, AND THEN BECOME THE DEVILS IN DISGUISE WHEN ITS TIME TO SOLVING THE WALL BRACING LAYOUT AND QUANTIFICATION PLAN. WITH ENOUGH EXPERIENCE PROJECTS WITH A LOT OF GLASS CAN BE PLANNED ALONG THE WAY TO AVOID THE FINAL CODE PREP SHOCK. THE CODE SPECIFIED PORTAL FRAME, OR THE MORE CUSTOMIZED RIGID FRAME DESIGN CAN BECOME A FRIEND.

*60' IS A MAX LINE TO LINE SPACING FOR SEISMIC ZONES A,B,C. SO THIS IS OK. BASELINE REQUIREMENTS ARE LISTED FOR 50FT AND 60 FT SPACING. INTERPOLATION PERMITTED IN THE CODE CHART



*THE LOCATION OF PANELS WITHIN THE LENGTH OF WALL ALSO HAVE CONDITIONS. SEE R602.10.2.2.
*AND THERE ARE END WALL CONDITIONS FOR CONTINUOUSLY SHEATHED WALLS, R602.10.7

DETERMINING WALL BRACING REQUIREMENTS

***EXAMPLE**_BASIC AND MORE CHALLENGING SITE AND HOUSE CONDITIONS BELOW INTENDED TO ILLUSTRATE HOW DIFFERENT QUIREMENTS CAN BE FOR THE SAME DESIGN CONDITION. THE SITE AND HOUSE GEOMETRY FOR THE MOST PART IS FIXED. THE PROCEDURAL VARIABLE IS THE NUMBER OF AND SPACING OF BRACING LINES WHICH DIRECTLY EFFECTS WALL BACING LENGTHS REQUIRED. THE BRACING LINE PLACEMENTS ARE USER DEFINED SO IF ONE ALLOCATION/POSITION SET FAILS TO FIND ENOUGH BRACING WALL ANOTHER CAN BE TESTED.
***BELOW NUMBERS**_BOTH SAMPLES AVOID THE D_0,D_1,D_2 SEISMIC CATAGORIES. REQUIREMENTS ARE MORE RIGOROUS AND IN FACT PRECLUDE 60' BRACING LINES (50' MAX), WHICH WOULD RENDER OUR SAMPLE BRACE LINE (56') OUT OF BOUNDS. IF A PROJECT IS IN SEISMIC ZONES D_0,D_1,D_2, ONE NEEDS TO SCAN THIS WHOLE CODE SECTION SPECIFICALLY FOR THOSE REQUIREMENTS. THEY ARE OFTEN, BUT NOT ALWAYS, DISTINCT FROM WIND ONLY BASED REQUIREMENTS.
***TABLE R602.3(1)**_SHOW CONDITIONS FOR THE 'CHECKING' CATEGORY BELOW
***TABLE R602.3(2)**_SHOW ITEMS FOR THE 'ADJUSTMENT' CATEGORY BELOW

LOCATION AND HOUSE DESIGN CONDITION 1_ BASIC

CHECKING

***WIND ZONE**_115 MPH
***SEISMIC ZONE**_B
***EXPOSURE**_B
***MEAN ROOF HT**_30'
***FLOOR AND ROOF ABOVE**_10' FLOOR TO FLOOR
***METHOD**_WSP (INTERMITTANT)
***(BASE) BRACING REQUIREMENTS**_9' (INTERPOLATED)

ADJUSTMENTS

***ITEM#1**_2 STORY STRUCTURE-B=1.0
***ITEM#2**_15' ROOF EAVE TO RIDGE=1.15
***ITEM#3**_STORY HT 10'=1.0
***ITEM#4**_2 BRACED WALL LINES=1.0
***ITEM#5**_NA THIS WALL
***ITEM#6**_NA THIS WALL
***ITEM#7**_NA THIS WALL
***ITEM#8_NA** BLOCKING INCLUDED
***TOTAL ADJUSTMENT 1.15=9' X 1.15=10.35'**

LOCATION AND HOUSE DESIGN CONDITION 1_ MORE CHALLENGING

CHECKING

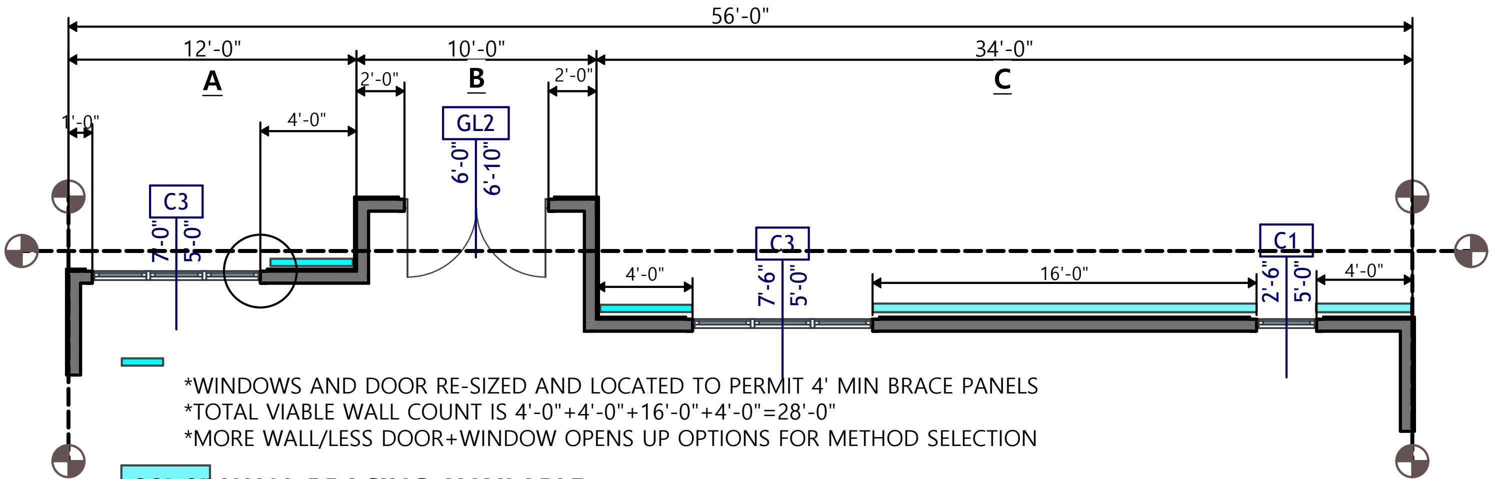
***WIND ZONE**_130 MPH
***SEISMIC ZONE**_C*
***EXPOSURE**_C
***MEAN ROOF HT**_37'
***FLOOR AND ROOF ABOVE**_11' FLOOR TO FLOOR
***METHOD**_WSP (INTERMITTANT)
***(BASE) BRACING REQUIREMENTS**_23.6' (INTERPOLATED)

ADJUSTMENTS

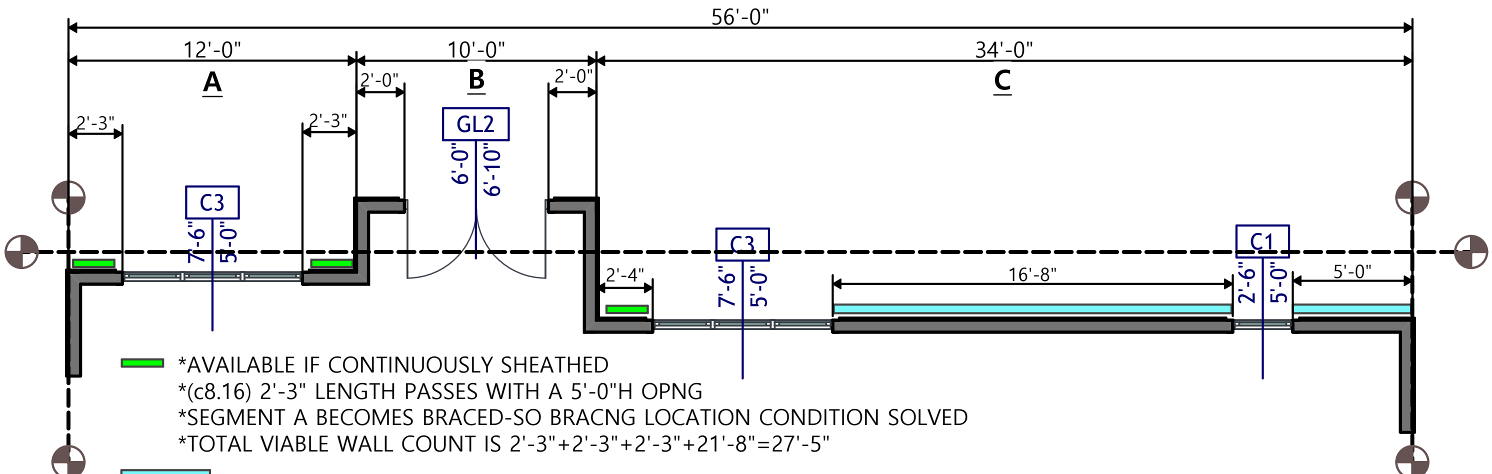
***ITEM#1**_2 STORY STRUCTURE-C=1.3
***ITEM#2**_15' ROOF EAVE TO RIDGE=1.15
***ITEM#3**_STORY HT 11'=1.05
***ITEM#4**_2 BRACED WALL LINES=1.0
***ITEM#5**_MAYBE NECESSARY
***ITEM#6**_NA THIS WALL
***ITEM#7**_NA THIS WALL
***ITEM#8_NA** BLOCKING INCLUDED
***TOTAL ADJUSTMENT=1.5-23.6' X 1.5=35.4**

OPTIONS FOR THIS BRACED WALL LINE

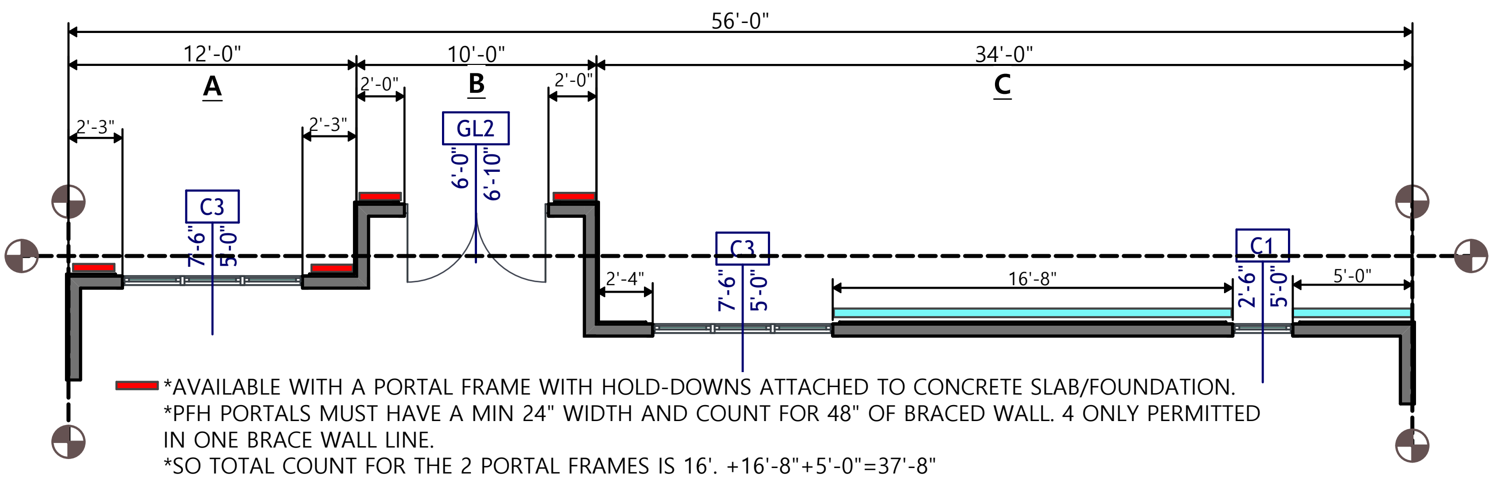
***1**_BWLA LESS THAT 4' IN EITHER DIRECTION-SO OK
***2**_56' AS DRAWN. FOR WIND BASED PARAMETERS 60' IS THE MAX SPACING-SO OK.
NOTE FOR PROJECTS IN SEISMIC ZONES D_0, D_1, D_2 THE SPACING LIMIT IS REDUCED.
***3**_SEGMENT **A** HAS ZERO, SEGMENT **B** HAS ZERO, SEGMENT **C** HAS 2 WALL RUNS THAT EXCEED 4'.
****OBSERVATION**_THESE 3 CHOICES ARE NOT EXHAUSTING ALL OPTIONS AVAILABLE. REMEMBER ALTERING THE ENTIRETY OF THE BRACING LINE DESIGN WILL EFFECT REQUIRED LENGTHS PER LINE. POSSIBLY ONE HAS A PRE SELECTED A 'METHOD'AND HAS TO FOLLOW ITS RULES, AND THEN MAKES DESIGN ADJUSTMENTS TO WALLS AND OPENINGS TO ALLOW IT TO WORK



28'-0" WALL BRACING AVAILABLE ACHIEVABLE WITH MOST OF THE 'METHODS'



27'-5" WALL BRACING AVAILABLE ONLY WITH CS- WSP



37-8' WALL BRACING AVAILABLE ONLY WITH 2-PFH PORTALS REQUIRING CONCRETE CONNECTED HOLD-DOWNS