<u>BUILDING CODES APPEALS BOARD</u>

Notice is hereby given of a meeting of the Building Codes Appeals Board to be held on April 08, 2014 at 6:00 P.M. at the City Hall Council Chambers, 604 West Fairmont Parkway, La Porte, Texas, regarding items of business according to the agenda listed below:

1. Call to order

2. Consider approval of minutes from the February 19, 2013 meeting.

3. Public Comments (Limited to five minutes per person)

4. Review, discuss and consider a recommendation to City Council regarding existing 120 mph wind load & possible recommendation regarding increasing the minimum wind load.

5. Review, discuss and consider a recommendation to City Council regarding 6" wall requirement for Residential and Commercial structures.

6. Establish next meeting date, time and topics

7. Adjourn

A quorum of City Council members may be present and participate in discussions during this meeting; however, no action will be taken by Council as a governing body.

In compliance with the Americans with Disabilities Act, the City of La Porte will provide for reasonable accommodations for persons attending public meetings. To better serve attendees, requests should be received 24 hours prior to the meetings. Please contact Patrice Fogarty, City Secretary, at 281.470.5019.

<u>CERTIFICATION</u>

I certify that a copy of the April 08, 2014 agenda of items to be considered by the City of La Porte Building Codes Appeals Board was posted on the City Hall bulletin board on the ____________ day of ________ ________, 2014.

____Title: ____

Out of consideration for all attendees of the meeting, please turn off all cell phones and pagers, or place on inaudible signal. Thank you for your consideration.

MINUTES

Building Codes Appeals Board
Minutes of February 19, 2013

Members Present: Tom Campbell, Ken Schlather, D. Paul Larson, and Lindsay Pfeiffer,

Members Absent: J.P. Jackson, Mark Follis, Terry Bunch

City Staff Present: Mark Huber- Deputy Building Official, Clark Askins- City Attorney

Others Present: N/A

1. **CALL TO ORDER**
   Meeting called to order at 6:05 P.M. by Chairman Tom Campbell.

2. **CONSIDER APPROVING MINUTES FROM THE JANUARY 15, 2013 MEETING**
   Motion to approve as written, was made by Lindsay Pfeiffer. Second by Ken Schlather. Motion passed- all in favor.

3. **PUBLIC COMMENTS (LIMITED TO FIVE MINUTES PER PERSON)**
   No Guests

4. **REVIEW, DISCUSS AND CONSIDER A RECOMMENDATION TO CITY COUNCIL RELATING TO A POSSIBLE CHANGE TO THE CITY'S ELECTRICAL CODE LOCAL AMENDMENTS (CHAPTER 82, CODE OF ORDINANCES)**

   Tom Campbell acknowledged Lindsey Pfeiffer. Lindsey Pfeiffer made a motion to amend the electrical ordinance to read:

   1) Section 82-308- Any where it states Master Electrician dealing with permitting, add the verbiage "or authorized representative"
   2) Section 82-338 Aluminum Conductors- Aluminum conductors may not be used in any wiring within residential buildings, nor in any residential underground service conductors.
      Aluminum conductors may only be used in commercial applications as follows:
      a) Outside aerial conductors
      b) Service entrance conductors
   3) Section 82-349 Add caps on BCAB

Motion- Ken Schlather, Second by Lindsey Pfeiffer- all in favor of motion to amend electrical ordinance. Motion passed.

5. **ADMINISTRATIVE REPORTS**

Mark Huber provided information regarding upcoming projects.

6. **BOARD COMMENTS ON MATTERS APPEARING ON AGENDA OR INQUIRY OF STAFF REGARDING SPECIFIC FACTUAL INFORMATION OF EXISTING POLICY.**

None

7. **ESTABLISH NEXT MEETING DATE, TIME AND TOPICS**

None

8. **ADJOURN**

Motion Lindsey Pfeiffer, Second Ken Schlather to adjourn meeting @ 6:50pm.
All in favor- Motion carried.

Respectfully submitted,

Mark Huber
Deputy Building Official

WINDLOAD REQUIREMENTS

ASCE 7-10 Wind Provisions and Effects on Wood Design and Construction

Philip Line, P.E.[1]
William L. Coulbourne, P.E. M.ASCE[2]

ABSTRACT

It is well known that the major change for wind design in *ASCE 7-10 Minimum Design Loads for Buildings and Other Structures* is the introduction of new wind speed maps that are referred to as ultimate wind speed maps in the *2012 International Building Code (IBC)*. Several other coordinated changes include:

- revised load factors for wind in allowable stress design (ASD) and load and resistance factor design (LRFD) load combinations,
- removal of the Occupancy Factor for wind,
- reinstating applicability of Exposure D in hurricane prone regions,
- revised wind speed triggers for definition of hurricane prone region and wind-borne debris region; and,
- revised pressure values for minimum design loads.

This paper will explore the net effect of these changes on calculated design velocity pressures and provide comparison tables for select geographic locations. It will also compare select provisions of *ASCE 7-10* with similar provisions in *ASCE 7-05*, and discuss implementation of *ASCE 7-10* in model codes and the *Wood Frame Construction Manual for One-and Two-family Dwellings (WFCM)*.

INTRODUCTION

Wind design in *ASCE 7-10* incorporates several major changes. Among the changes are new wind speed maps that vary by risk category (e.g. separate maps are provided for each of the following risk categories: I, II, and III, and IV) and incorporation of uniform recurrence interval wind speed contours throughout all geographic regions including hurricane prone regions of the U.S. These changes directly affect calculation of unfactored wind loads. Revised load factors for wind in ASD and LRFD load combinations were coordinated to compensate for the new wind speeds, resulting in design velocity pressures that are very similar to those calculated using provisions of *ASCE 7-05* for most U.S. regions. In addition, recent studies of hurricane winds over open water resulted in changes to hurricane wind modeling that, in general, increased wind speeds near the hurricane "eye," reduced wind speeds over the broader storm area, and revised the definition of Exposure D so that it is no longer precluded from being applicable in hurricane prone regions.

The outcome of these changes are that design velocity pressures are reduced in some hurricane prone regions while design velocity pressures remain largely unchanged in non-hurricane prone regions. To confirm this, design velocity pressure per *ASCE 7-10* was calculated and compared to design velocity pressure determined in accordance with *ASCE 7-05*. In addition to serving as limited confirmation of generally expected outcomes, the purpose of the comparison is two-fold: to illustrate where differences in calculations occur; and provide insight into the effect of changes on calculated pressures for specific locations and buildings of varying risk categories.

Changes in *ASCE 7-10* that coordinate with the introduction of new maps include: 1) revised wind speed triggers defining hurricane prone regions and wind-borne debris regions, and 2) revised pressure values for minimum design loads. Model building codes and standards that rely on the new wind design approach in *ASCE 7-10* include the *2012 International Residential Code (IRC)*, the *2012 IBC*, and the *2012 WFCM*; however, each of these documents addresses implementation of *ASCE 7-10* wind provisions differently.

DESIGN VELOCITY PRESSURE EXAMPLE

Design velocity pressures calculated herein are intended to allow comparison of *ASCE 7-10* and *ASCE 7-05* and represent factored pressures from use of ASD or LRFD load combinations contained in *ASCE 7*.

ASCE 7-05 Velocity Pressure

$$q_{z05} = 0.00256 K_z K_{zt} K_d V^2 I \qquad \text{(Eq. 1)}$$

where:

q_{z05} = ASCE 7-05 velocity pressure evaluated at mean roof height (psf)
K_z = velocity pressure exposure coefficient
K_{zt} = topographic factor
K_d = wind directionality factor
V = basic wind speed (mph) from *ASCE 7-05* maps
I = Importance factor (1.0 for Category II buildings, 1.15 for Category III and IV buildings)

Design velocity pressure for ASD and LRFD are:

ASD: $q_{z05\_ASD} = (1.0)(q_{z05})$ (Eq. 2)
LRFD: $q_{z05\_LRFD} = (1.6)(q_{z05})$ (Eq. 3)

where:

1.0 = *ASCE 7-05* ASD load factor for wind
1.6 = *ASCE 7-05* LRFD load factor for wind

ASCE 7-10 Velocity Pressure

$$q_{z10} = 0.00256 K_z K_{zt} K_d V^2 \qquad \text{(Eq. 4)}$$

where:

q_{z10} = *ASCE 7-10* velocity pressure evaluated at mean roof height (psf)
K_z = velocity pressure exposure coefficient
K_{zt} = topographic factor
K_d = wind directionality factor
V = basic wind speed (mph) from *ASCE 7-10* maps referred to as ultimate wind speed maps in *2012 IBC*.

Design velocity pressure for ASD and LRFD are:

$$\text{ASD: } q_{z10\_ASD} = (0.6)(q_{z10}) \qquad \text{(Eq. 5)}$$
$$\text{LRFD: } q_{z10\_LRFD} = (1.0)(q_{z10}) \qquad \text{(Eq.6)}$$

where:

0.6	=	*ASCE 7-10* ASD load factor for wind
1.0	=	*ASCE 7-10* LRFD load factor for wind

Values for the topographic factor are taken as 1.0 and the wind directionality factor is taken as 0.85. *ASCE 7-10* and *ASCE 7-05* equations for calculation of design velocity pressure have a similar form and are easily compared. For example, the importance factor applicable in *ASCE 7-05* calculations is not a specific factor in the *ASCE 7-10* calculation (i.e. building or structure importance is addressed by use of separate wind speed maps that vary by risk category in *ASCE 7-10*); and load factors for calculation of ASD and LRFD design wind pressures are different. The effects of these changes on design velocity pressure, when combined with changes to the mapped basic wind speed, are less obvious. To see effects, equations 1 through 6 are applied to buildings of different risk categories in different U.S. locations.

Risk Category and Building Location

Design velocity pressures for specific building locations and risk categories are shown in Table 1. All locations are within the hurricane prone region with the exception of Dallas, TX. Wind speeds shown for each location within the hurricane prone region are taken from *ASCE 7 Commentary* Tables C26.5-3. From Table 1, it can be seen that for a given location under *ASCE 7-10*, mapped velocity varies by risk category. For example, in Miami, FL, Risk Category II has a design wind speed of 170 mph while Risk Categories III and IV have a design wind speed of 180 mph.

Use of the term "risk category" and descriptions of varying risk categories in *ASCE 7-10* is new. For purposes of comparison in this paper, risk categories in *ASCE 7-10* are analogous to the familiar occupancy categories in *ASCE 7-05*. For example, Risk Category II can be associated with most residential dwellings and other buildings and structures with limited occupancies (e.g. those that are not Risk Category I, III, or IV). Risk Category III is associated with building types that pose substantial risk to human life and Risk Category IV is associated with buildings that are designated as essential facilities.

Table 1. Comparison of design velocity pressures between *ASCE 7-10* Exposure C and *ASCE 7-05* Exposure C

		ASCE 7-10			*ASCE 7-05*		
Location	Risk Category	Design Wind Speed (MPH)	ASD Velocity Pressure[1] (psf)	LRFD Velocity Pressure[1] (psf)	Design Wind Speed (MPH)	ASD Velocity Pressure[1] (psf)	LRFD Velocity Pressure[1] (psf)
Boston, MA	II	128	21.4	35.7	105	24.0	38.4
VA Beach, VA	II	122	19.4	32.4	114	28.3	45.2
Miami, FL	II	170	37.7	62.9	146	46.4	74.2
Galveston, TX	II	150	29.4	49.0	132	37.9	60.7
Dallas, TX	II	115	17.3	28.8	90	17.6	28.2
Boston, MA	III, IV	140	25.6	42.6	105	27.6	44.1
VA Beach, VA	III, IV	132	22.7	37.9	114	32.5	52.0
Miami, FL	III, IV	181	42.8	71.3	146	53.3	85.3
Galveston, TX	III, IV	160	33.4	55.7	132	43.6	69.8
Dallas, TX	III, IV	120	18.8	31.3	90	20.3	32.4

[1] Exposure C at 33' mean roof height, $K_z = 1.0$.

Exposure Category D

Table 2 provides the same information as Table 1 except *ASCE 7-10* design velocity pressure is calculated assuming Exposure D (e.g. sites where flat, unobstructed areas and water surfaces prevail in the upwind direction). For an assumed 33' mean roof height, design pressures calculated in accordance with *ASCE 7-10* for Exposure D are 18% greater than those for Exposure C. Design velocity pressures for *ASCE 7-05* in Table 2 are based on Exposure C because Exposure D is not applicable in hurricane prone regions per *ASCE 7-05*.

Effect of mean roof height is a factor in calculation of design velocity pressure. For the example in this paper, all calculations are based on a mean roof height of 33' which corresponds to the height limit of the *WFCM*. The value of the velocity pressure exposure coefficient, K_z, for Exposure C and 60' mean roof height is K_z =1.13. For Exposure D and 60' mean roof height, the value of K_z = 1.31. The ratio of Exposure D to Exposure C at this height is 1.16 indicating reduced influence of Exposure D as building height increases.

Table 2. Comparison of design velocity pressures between *ASCE 7-10* Exposure D and *ASCE 7-05* Exposure C

Location	Risk Category	*ASCE 7-10*[1] Design Wind Speed (MPH)	ASD Velocity Pressure[1] (psf)	LRFD Velocity Pressure[1] (psf)	*ASCE 7-05*[2] Design Wind Speed (MPH)	ASD Velocity Pressure[2] (psf)	LRFD Velocity Pressure[2] (psf)
Boston, MA	II	128	25.2	42.1	105	24.0	38.4
VA Beach, VA	II	122	22.9	38.2	114	28.3	45.2
Miami, FL	II	170	44.5	74.2	146	46.4	74.2
Galveston, TX	II	150	34.7	57.8	132	37.9	60.7
Boston, MA	III, IV	140	30.2	50.3	105	27.6	44.1
VA Beach, VA	III, IV	132	26.8	44.7	114	32.5	52.0
Miami, FL	III, IV	181	50.5	84.1	146	53.3	85.3
Galveston, TX	III, IV	160	39.4	65.7	132	43.6	69.8

[1] Exposure D at 33' mean roof height, $K_z = 1.18$.
[2] Exposure C at 33' mean roof height, $K_z = 1.0$.

Wind Load Factors

The ratio of ASD to LRFD design wind pressures in Tables 1 and 2 is constant as would be expected based on the applicable equations. A slight reduction in ASD pressures relative to LRFD pressures results from the load factor differences between *ASCE 7-10* and *ASCE 7-05* (i.e. ratio of 0.6 versus 0.625 where 0.6 = 0.6/1.0 and 0.625 = 1/1.6). The precise value of the reduction in ASD load relative to LRFD load between *ASCE 7-10* and *ASCE 7-05* due to load factor changes alone is 0.6/0.625 = 0.96 or 4 percent.

Table 3. Comparison of LRFD design velocity pressures based on *ASCE 7-10* and *ASCE 7-05*

Location	Risk Category	*ASCE 7-10* Design Wind Speed (MPH)	[A] Exp C Velocity Pressure[2] (psf)	[B] Exp D Velocity Pressure[1] (psf)	*ASCE 7-05* Design Wind Speed (MPH)	[C] Exp C Velocity Pressure[2] (psf)	Ratio [A]/[C]	Ratio [B]/[C]
Boston, MA	II	128	35.7	42.1	105	38.4	0.93	1.10
VA Beach, VA	II	122	32.4	38.2	114	45.2	0.72	0.84
Miami, FL	II	170	62.9	74.2	146	74.2	0.85	1.00
Galveston, TX	II	150	49.0	57.8	132	60.7	0.81	0.95
Dallas, TX	II	115	28.8	-	90	28.2	1.02	-
Boston, MA	III, IV	140	42.6	50.3	105	44.1	0.97	1.14
VA Beach, VA	III, IV	132	37.9	44.7	114	52.0	0.73	0.86
Miami, FL	III, IV	181	71.3	84.1	146	85.3	0.84	0.99
Galveston, TX	III, IV	160	55.7	65.7	132	69.8	0.80	0.94
Dallas, TX	III, IV	120	31.3	-	90	32.4	0.97	-

[1] Exposure D at 33' mean roof height (for *ASCE 7-10* only), $K_z = 1.18$.
[2] Exposure C at 33' mean roof height, $K_z = 1.0$.

Summary design velocity pressure comparison between *ASCE 7-10* and *ASCE 7-05*
Table 3 compares the relative increase or decrease in design velocity pressures based on location, building risk category, and exposure.

The inland location, Dallas, TX, shows only small differences between *ASCE 7-10* and *ASCE 7-05*. Locations outside of the hurricane prone region, not including special wind regions, can be generally represented by a ratio of approximately 1.0 (see Table 3, column [A]/[C]) as shown for Dallas, TX.

An expected outcome, due to the uniform hazard basis of the new maps, is that design pressures for Exposure C locations in the hurricane prone region are smaller under *ASCE 7-10* than *ASCE 7-05* (i.e. ratio values are less than 1.0 in Table 3, column [A]/[C]).

In this example, the effect of new maps and applicability of Exposure D in hurricane prone regions relative to Exposure C in *ASCE 7-05* varies by location (see Table 3, column [B]/[C]). An approximate 10 percent increase in design pressure is observed for Boston, MA and an approximate 16 percent decrease in design pressure is observed for Virginia Beach, VA.

MINIMUM DESIGN WIND LOADS
Minimum wind load provisions of *ASCE 7-10* for design of main wind force resisting systems (MWFRS) under the directional procedure and envelop procedure, have also been revised to specify a minimum 16 psf wall pressure and a minimum roof pressure of 8 psf projected onto a vertical plane (see Figure 1). For comparison, the minimum design value of 10 psf, applicable for both walls and roofs under *ASCE 7-05*, when factored for LRFD is 16 psf (i.e. 10 psf x 1.6 = 16 psf) which identically matches the LRFD pressure of 16 psf for walls under *ASCE 7-10*.

Under *ASCE 7-05* and prior editions, the net force for some elements of the MWFRS were smaller than would result from minimum pressure requirements. The minimum LRFD pressures of 8 psf for roofs and 16 psf for walls in *ASCE 7-10* are now less likely to be the controlling minimum design wind loads for some building configurations, particularly in lower wind speed regions and for low-rise buildings designed in accordance with the envelop procedure for low-rise buildings.

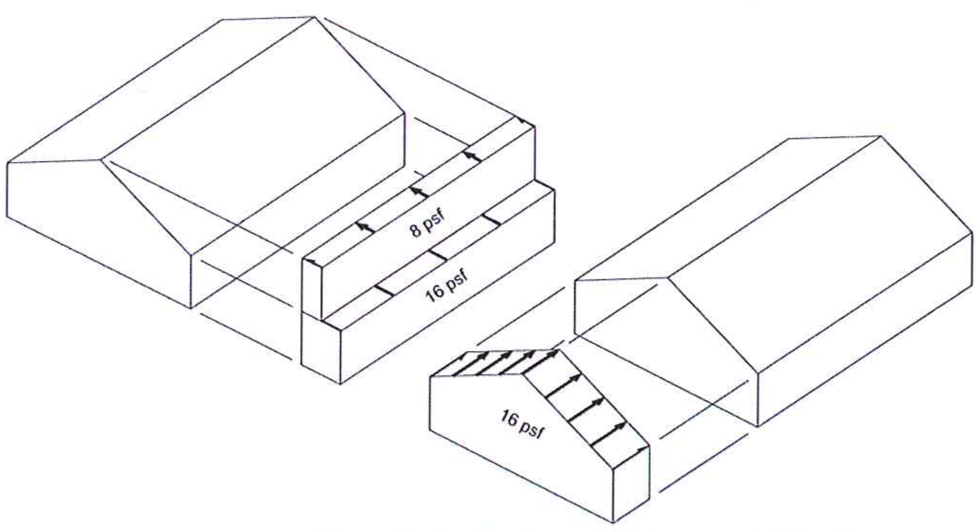

Figure 1. Application of minimum wind load.

WIND SPEED TRIGGERS

The geographic area within the hurricane prone region per ASCE 7-05 and ASCE 7-10 are shown in Figure 2. It can be seen that the geographic area for hurricane prone regions is reduced in portions of the southeast including Georgia, South Carolina, Alabama, and Mississippi. The wind speed trigger in *ASCE 7-10* for hurricane prone regions is 115 mph from Risk Category II maps and represents an algebraic conversion of the 90 mph wind speed trigger in *ASCE 7-05*. Revised wind speed triggers for wind-borne debris regions do not follow the same conversion and exclusive linkage to wind speed maps for Risk Category II. A comparison of these new values and revised definitions is provided in Table 4.

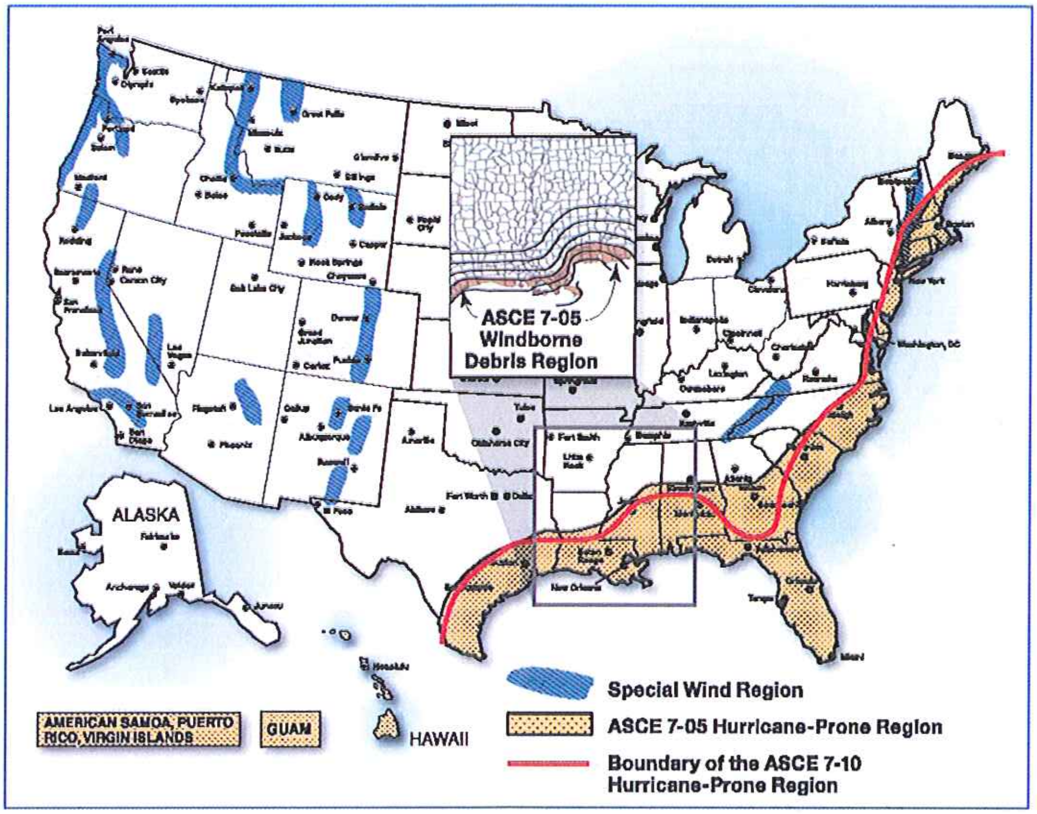

Figure 2. Illustration of hurricane prone regions (FEMA P-804).

Table 4. Comparison of wind speed values for use in *ASCE 7* definitions of hurricane prone regions and wind-borne debris regions.

ASCE 7 Term	*ASCE 7-10*	*ASCE 7-05*
Hurricane Prone Regions[1]	Areas vulnerable to hurricanes; in the United States and its territories defined as: 1. The U.S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed for Risk Category II buildings is greater than 115 mi/h, and 2. Hawaii, Puerto Rico, Guam, Virgin Islands, and American Samoa.	Areas vulnerable to hurricanes; in the United States and its territories defined as: 1. The U.S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed is greater than 90 mi/h, and 2. Hawaii, Puerto Rico, Guam, Virgin Islands, and American Samoa.
Wind-borne Debris Regions[2]	Areas within hurricane prone regions where impact protection is required for glazed openings, see Section 26.10.3. 26.10.3 Glazed openings shall be protected in accordance with Section 26.10.3.2 in the following locations: 1. Within 1 mi of the coastal mean high water line where the basic wind speed is equal to or greater than 130 mi/h, or 2. In areas where the basic wind speed is equal to or greater than 140 mi/hr.	Areas within hurricane prone regions located: 1. Within 1 mile of the coastal mean high water line where the basic wind speed is equal to or greater than 110 mi/h and in Hawaii, or 2. In areas where the basic wind speed is equal to or greater than 120 mi/h.

1. Wind speed limit in *ASCE 7-10* corresponds to the rounded value from the following relationship: $V_{\_ASCE7\text{-}10} = V_{\_ASCE7\text{-}05} \times (1.6)^{1/2}$.
2. See *ASCE 7* for detailed information on glazed opening protection and considerations for new treatment of Risk Category under *ASCE 7-10*. Both *ASCE 7-05* and *ASCE 7-10* contain an exception to glazed opening protection based on height above ground and proximity to aggregate surfaced roofs.

Under *ASCE 7-10* provisions for glazed opening protection, wind speed maps associated with Risk Category II are used for all Risk Category II buildings and structures and Risk Category III buildings except for health care facilities. Wind speed maps for Risk Category III and IV are used for Risk Category III health care facilities and Risk Category IV buildings and structures.

The combined effect of map changes and revised wind speed triggers is that there are location- and building-specific differences between *ASCE 7-10* and *ASCE 7-05* requirements. These differences can be significant. For example, some locations and building types may require glazed opening protection under *ASCE 7-10* where opening protection was not previously required under *ASCE 7-05*.

COORDINATION WITH CODES AND STANDARDS

Wind provisions of *ASCE 7-10* are recognized in the *2012 IRC*, the *2012 IBC,* and the *2012 WFCM*; however, each of these documents addresses implementation of *ASCE 7-10* wind provisions differently.

IBC adopts *ASCE 7-10* provisions for wind design by reference and incorporates *ASCE 7-10* wind speed maps. A conversion of mapped wind speed to an ASD basis (i.e. V_{asd} per *2012 IBC* is calculated as $V_{asd} = V_{ult} \times 0.6^{1/2}$) is added to the *IBC* to coordinate with previously established *IBC* wind speed triggers, many of which remain unchanged. For wood construction, the conversion from ultimate to ASD-based wind speed is needed to use: tables for attachment of wood structural panels for wind, wind applicability limits for conventional light-frame construction, and wind uplift connector requirements in *IBC* Section 2308.

Within the *IRC*, new maps illustrate ASD-based wind speeds. The *IRC* format of the wind speed map eliminates the need for conversion of the mapped value as is done in the *IBC*; however, the mapped contour lines do not directly align with those in *ASCE 7-10* maps incorporated in the *IBC*.

The *2012 WFCM* will include *ASCE 7-10* Risk Category II wind speed maps and tabulate requirements for wind speeds ranging from 110 mph to 195 mph for both Exposures B and C. The reinstatement of Exposure D in *ASCE 7-10* is a new consideration for the *WFCM* as prior editions provided tabulated requirements for Exposure B and C only, with a conversion table to adjust tabular values in Chapter 2 for Exposure D. The removal of the occupancy factor adjustment to wind loads will generally limit applicability of *WFCM* load tables. While prior *WFCM* load tables were based on occupancy category II, they were easily adjusted by the occupancy factor to estimate loads for other occupancy types.

CONCLUSIONS

Changes in wind design provisions introduced in *ASCE 7-10* produce the greatest differences in design velocity pressures for areas within the hurricane prone region. For Exposure D sites, design velocity pressures can be both larger (Boston, MA) and smaller (Virginia Beach, VA) than those determined in accordance with *ASCE 7-05*. For Exposure C sites, design velocity pressures were as much as 28 percent smaller than those calculated using *ASCE 7-05* for sites evaluated in this paper. Changes to design velocity pressures followed the same trends for Risk Category II, III, and IV buildings.

Revised minimum wind loads in *ASCE 7-10* will reduce occurrences where they control in lieu of more detailed methods for calculation of wind pressures for MWFRS. Additionally, changes to wind speed maps and load factors for wind are coordinated with revision of familiar wind speed and wind load triggers. For example, hurricane prone regions in *ASCE 7-10* are associated with mapped wind speeds of 115 mph and higher instead of 90 mph and higher in *ASCE 7-05;* with similar wind speed revisions occurring for definition of wind-borne debris regions. Similarly, the minimum wind load for walls is given as 16 psf in *ASCE 7-10* instead of the familiar 10 psf in *ASCE 7-05*.

Model building codes and standards that rely on the new wind design approach in *ASCE 7-10* include the *2012 IRC*, the *2012 IBC,* and the *2012 WFCM*. Each of these documents addresses implementation of *ASCE 7-10* in a different manner. For design of wood construction in accordance with the *WFCM*, it is expected that the Risk Category II wind speed map will be incorporated as it appears in *ASCE 7-10* and tabulated requirement within the *WFCM* will be associated with *ASCE 7-10* mapped wind speeds.

REFERENCES

American Society of Civil Engineers, ASCE 7-05, *Minimum Design Loads for Buildings and Other Structures*, Reston, VA, 2005.

American Society of Civil Engineers, ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*, Reston, VA, 2010.

International Code Council, *2012 International Building Code*. Washington, DC, 2011.

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WINDLOAD
COMPARISON TABLE

Summary of How the Codes Changed from 2009 to 2012 for Wind

The 2009 IRC and IBC both reference and utilize ASCE 7-05 "Minimum Design Loads for Buildings and Other Structures" for structural loads and requirements.

The 2012 IRC and IBC both reference and utilize ASCE 7-10 "Minimum Design Loads for Buildings and Other Structures" for structural loads and requirements.

The ASCE 7-10 manual made significant changes to the wind load section which went from 1 chapter in ASCE 7-05 to 6 chapters in ASCE 7-10. These changes were intended to better organize the various wind design approaches and building types into separate chapters and to normalize wind design on the Strength Design approach. Previously, the wind design was normalized on the Allowable Stress Design approach. In addition, the new ASCE 7-10 manual eliminated using importance factors with only one local wind speed map to using the three wind speed maps which are based on the risk category of the building or structure.

The wind speeds used for determining the design wind pressure are higher in the 2012 codes. For example, a 120 mph wind speed in the 2009 code is equivalent to a 152 mph wind speed in the 2012 code. In the 2009 codes and in the 2012 codes, the design wind pressure is essentially calculated the same way except for using different wind speeds for the different risk categories instead of the importance factors used in the 2009 codes. The main difference between the codes is how the design wind pressure is applied as wind loading on a structure using the different load factors for either Strength Design or Allowable Stress Design.

In the 2009 codes, the Strength Design approach multiplied the design wind pressure by a load factor of 1.6 and the Allowable Stress Design approach multiplied the design wind pressure by a load factor of 1.0.

In the 2012 codes, the Strength Design approach multiplies the design wind pressure by a load factor of 1.0 and the Allowable Stress Design approach multiplies the design wind pressure by a load factor of 0.6.

So while the design wind pressures are higher using the new wind speed maps in the 2012 codes, the actual wind loadings used to design a structure are less.

The attached tables show the calculated wind loadings utilizing the Allowable Stress Design for different building types and with different exposures.

Supplemental Explanation of Tables

Table 1

Column 1 - shows design case used as the basis for the calculations

Column 2 - shows the different construction element for which the wind load was calculated

Column 3 - shows the calculated wind loads using the 2009 codes

Column 4 - shows the calculated wind loads using the 2012 codes with the current local amendment of 120 mph.

Column 5 - shows the calculated wind loads using the 2012 codes with no local amendment and allowing interpolation on the wind maps.

Table 2

Column 1 - shows design case used as the basis for the calculations

Column 2 - shows the different construction element for which the wind load was calculated

Column 3 - shows the calculated wind loads using the 2009 codes

Column 4 - shows the calculated wind loads using the 2012 codes with no local amendment and allowing interpolation on the wind maps.

Column 5 - shows the calculated wind loads using the 2012 codes with a local amendment stating the wind speeds to be used for the three maps. This approach basically does not allow interpolation on the wind maps since the higher wind line is used.

Wind Load Comparison Table 1
Based on Allowable Stress Design

Design Case	Construction Element	2009 IBC, ASCE 7-05 Local Amendment Wind Speed V = 120	2012 IBC, ASCE 7-10 Local Amendment Wind Speed V = 120	2012 IBC, ASCE 7-10 No Local Amendment Wind Speed from Figures
Basic Commercial Building Occupancy Category II Importance Factor = 1.0 Risk Category II Exposure B	 Wall Framing Roof Framing Wall Covering Roof Covering	Wind Load @ V = 120 22.81 psf - 27.42 psf - 34.66 psf - 65.36 psf	Wind Load @ V = 120 13.69 psf - 16.45 psf - 20.79 psf - 39.22 psf	Wind Load @ V = 143 19.44 psf - 23.36 psf - 29.53 psf - 55.69 psf
Basic Commercial Building Occupancy Category II Importance Factor = 1.0 Risk Category II Exposure C	 Wall Framing Roof Framing Wall Covering Roof Covering	Wind Load @ V = 120 27.70 psf - 33.29 psf - 42.08 psf - 79.37 psf	Wind Load @ V = 120 16.62 psf - 19.98 psf - 25.25 psf - 47.62 psf	Wind Load @ V = 143 23.60 psf - 28.37 psf - 35.86 psf - 67.63 psf
High Occupancy Building Occupancy Category III Importance Factor = 1.15 Risk Category III Exposure B	 Wall Framing Roof Framing Wall Covering Roof Covering	Wind Load @ V = 120 26.23 psf - 31.53 psf - 39.85 psf - 75.17 psf	Wind Load @ V = 120 13.69 psf - 16.45 psf - 20.79 psf - 39.22 psf	Wind Load @ V = 153 22.25 psf - 26.74 psf - 33.80 psf - 63.75 psf
High Occupancy Building Occupancy Category III Importance Factor = 1.15 Risk Category III Exposure C	 Wall Framing Roof Framing Wall Covering Roof Covering	Wind Load @ V = 120 31.85 psf - 38.29 psf - 48.39 psf - 91.28 psf	Wind Load @ V = 120 16.62 psf - 19.98 psf - 25.25 psf - 47.62 psf	Wind Load @ V = 153 27.02 psf - 32.47 psf - 41.05 psf - 77.42 psf
Low Risk Building Storage Building or Barn Occupancy Category I Importance Factor = 0.77 Risk Category I Exposure C	 Wall Framing Roof Framing Wall Covering Roof Covering	Wind Load @ V = 120 21.33 psf - 25.64 psf - 32.40 psf - 61.11 psf	Wind Load @ V = 120 16.62 psf - 19.98 psf - 25.25 psf - 47.62 psf	Wind Load @ V = 135 21.03 psf - 25.28 psf - 31.96 psf - 60.27 psf

Wind Load Comparison Table 2
Based on Allowable Stress Design

Design Case	Construction Element	2009 IBC, ASCE 7-05 Local Amendment Wind Speed V = 120	2012 IBC, ASCE 7-10 No Local Amendment Wind Speed from Figures	2012 IBC, ASCE 7-10 Local Amendment VI = 140, VII = 150, VIII = 160
Basic Commercial Building Occupancy Category II Importance Factor = 1.0 Risk Category II Exposure B	 Wall Framing Roof Framing Wall Covering Roof Covering	 Wind Load @ V = 120 22.81 psf - 27.42 psf - 34.66 psf - 65.36 psf	 Wind Load @ V = 143 19.44 psf - 23.36 psf - 29.53 psf - 55.69 psf	 Wind Load @ V = 150 21.39 psf - 25.70 psf - 32.49 psf - 61.28 psf
Basic Commercial Building Occupancy Category II Importance Factor = 1.0 Risk Category II Exposure C	 Wall Framing Roof Framing Wall Covering Roof Covering	 Wind Load @ V = 120 27.70 psf - 33.29 psf - 42.08 psf - 79.37 psf	 Wind Load @ V = 143 23.60 psf - 28.37 psf - 35.86 psf - 67.63 psf	 Wind Load @ V = 150 25.97 psf - 31.21 psf - 39.45 psf - 74.41 psf
High Occupancy Building Occupancy Category III Importance Factor = 1.15 Risk Category III Exposure B	 Wall Framing Roof Framing Wall Covering Roof Covering	 Wind Load @ V = 120 26.23 psf - 31.53 psf - 39.85 psf - 75.17 psf	 Wind Load @ V = 153 22.25 psf - 26.74 psf - 33.80 psf - 63.75 psf	 Wind Load @ V = 160 24.33 psf - 29.25 psf - 36.97 psf - 69.72 psf
High Occupancy Building Occupancy Category III Importance Factor = 1.15 Risk Category III Exposure C	 Wall Framing Roof Framing Wall Covering Roof Covering	 Wind Load @ V = 120 31.85 psf - 38.29 psf - 48.39 psf - 91.28 psf	 Wind Load @ V = 153 27.02 psf - 32.47 psf - 41.05 psf - 77.42 psf	 Wind Load @ V = 160 29.55 psf - 35.51 psf - 44.89 psf - 84.66 psf
Low Risk Building Storage Building or Barn Occupancy Category I Importance Factor = 0.77 Risk Category I Exposure C	 Wall Framing Roof Framing Wall Covering Roof Covering	 Wind Load @ V = 120 21.33 psf - 25.64 psf - 32.40 psf - 61.11 psf	 Wind Load @ V = 135 21.03 psf - 25.28 psf - 31.96 psf - 60.27 psf	 Wind Load @ V = 140 22.62 psf - 27.19 psf - 34.37 psf - 64.82 psf

Local Amendments for City of La Porte Building Codes for Wind Related Sections

Below are the local amendments recommended for the 2012 IRC and IBC with respect to the wind speeds to be used for the City of La Porte.

Sec. 82-32 Residential Code Amendments

Replace 120 with "See Note" in wind speed column of Table R301.2(1)

Below the table add the following Note:

Wind Speed Note: For the City, wind speed to be 120 mph for Section R301.2.1.1 and for use with Table R301.2(2), or for use with the methods listed in Section R301.2.1.1 or with other methods that utilize ASCE 7-05. The wind speed shall be 150 mph for any approved methods that utilize ASCE 7-10.

Sec. 82-33 Building Code Amendments

Chapter 16. Basic wind speeds for the City shall be as follows:
Figure 1609A, Ultimate Design Wind Speed (3-Second Gust) - 150 MPH
Figure 1609B, Ultimate Design Wind Speed (3-Second Gust) - 160 MPH
Figure 1609C, Ultimate Design Wind Speed (3-Second Gust) - 140 MPH

6" STUD WALL REQUIREMENTS and Ordinance 96-2079-I

<u>NOTICE</u>

MINIMUM 6" STUD WALL REQUIREMENTS

EFFECTIVE JUNE 24, 2006

Effective June 24, 2006, the City of La Porte will begin enforcing the "new" minimum 6" stud wall requirement where drain, waste, and/or vent plumbing will be installed, in accordance with Ordinance 96-2079-I, approved by City Council on April 24, 2006.

thereto to provide adequate lateral support. Bridging shall be placed in every stud cavity and at a frequency such that no stud so braced shall have a height-to-least-thickness ratio exceeding 50 with the height of the stud measured between horizontal framing and bridging or between bridging, whichever is greater.

2308.9.10 Cutting and notching. In exterior walls and bearing partitions, any wood stud is permitted to be cut or notched to a depth not exceeding 25 percent of its width. Cutting or notching of studs to a depth not greater than 40 percent of the width of the stud is permitted in nonbearing partitions supporting no loads other than the weight of the partition.

2308.9.11 Bored holes. A hole not greater in diameter than 40 percent of the stud width is permitted to be bored in any wood stud. Bored holes not greater than 60 percent of the width of the stud are permitted in nonbearing partitions or in any wall where each bored stud is doubled, provided not more than two such successive doubled studs are so bored.

In no case shall the edge of the bored hole be nearer than $^5/_8$ inch (15.9 mm) to the edge of the stud.

Bored holes shall not be located at the same section of stud as a cut or notch.

2308.10 Roof and ceiling framing. The framing details required in this section apply to roofs having a minimum slope of three units vertical in 12 units horizontal (25-percent slope) or greater. Where the roof slope is less than three units vertical in 12 units horizontal (25-percent slope), members supporting rafters and ceiling joists such as ridge board, hips and valleys shall be designed as beams.

2308.10.1 Wind uplift. The roof construction shall have rafter and truss ties to the wall below. Resultant uplift loads shall be transferred to the foundation using a continuous load path. The rafter or truss to wall connection shall comply with Tables 2304.9.1 and 2308.10.1.

2308.10.2 Ceiling joist spans. Allowable spans for ceiling joists shall be in accordance with Table 2308.10.2(1) or

TABLE 2308.9.6
HEADER AND GIRDER SPANS[a] FOR INTERIOR BEARING WALLS
(Maximum Spans for Douglas Fir-Larch, Hem-Fir, Southern Pine and Spruce-Pine-Fir[b] and Required Number of Jack Studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING width[c] (feet)					
		20		28		36	
		Span	NJ[d]	Span	NJ[d]	Span	NJ[d]
One Floor Only	2-2×4	3-1	1	2-8	1	2-5	1
	2-2×6	4-6	1	3-11	1	3-6	1
	2-2×8	5-9	1	5-0	2	4-5	2
	2-2×10	7-0	2	6-1	2	5-5	2
	2-2×12	8-1	2	7-0	2	6-3	2
	3-2×8	7-2	1	6-3	1	5-7	2
	3-2×10	8-9	1	7-7	2	6-9	2
	3-2×12	10-2	2	8-10	2	7-10	2
	4-2×8	9-0	1	7-8	1	6-9	1
	4-2×10	10-1	1	8-9	1	7-10	2
	4-2×12	11-9	1	10-2	2	9-1	2
Two Floors	2-2×4	2-2	1	1-10	1	1-7	1
	2-2×6	3-2	2	2-9	2	2-5	2
	2-2×8	4-1	2	3-6	2	3-2	2
	2-2×10	4-11	2	4-3	2	3-10	3
	2-2×12	5-9	2	5-0	3	4-5	3
	3-2×8	5-1	2	4-5	2	3-11	2
	3-2×10	6-2	2	5-4	2	4-10	2
	3-2×12	7-2	2	6-3	2	5-7	3
	4-2×8	6-1	1	5-3	2	4-8	2
	4-2×10	7-2	2	6-2	2	5-6	2
	4-2×12	8-4	2	7-2	2	6-5	2

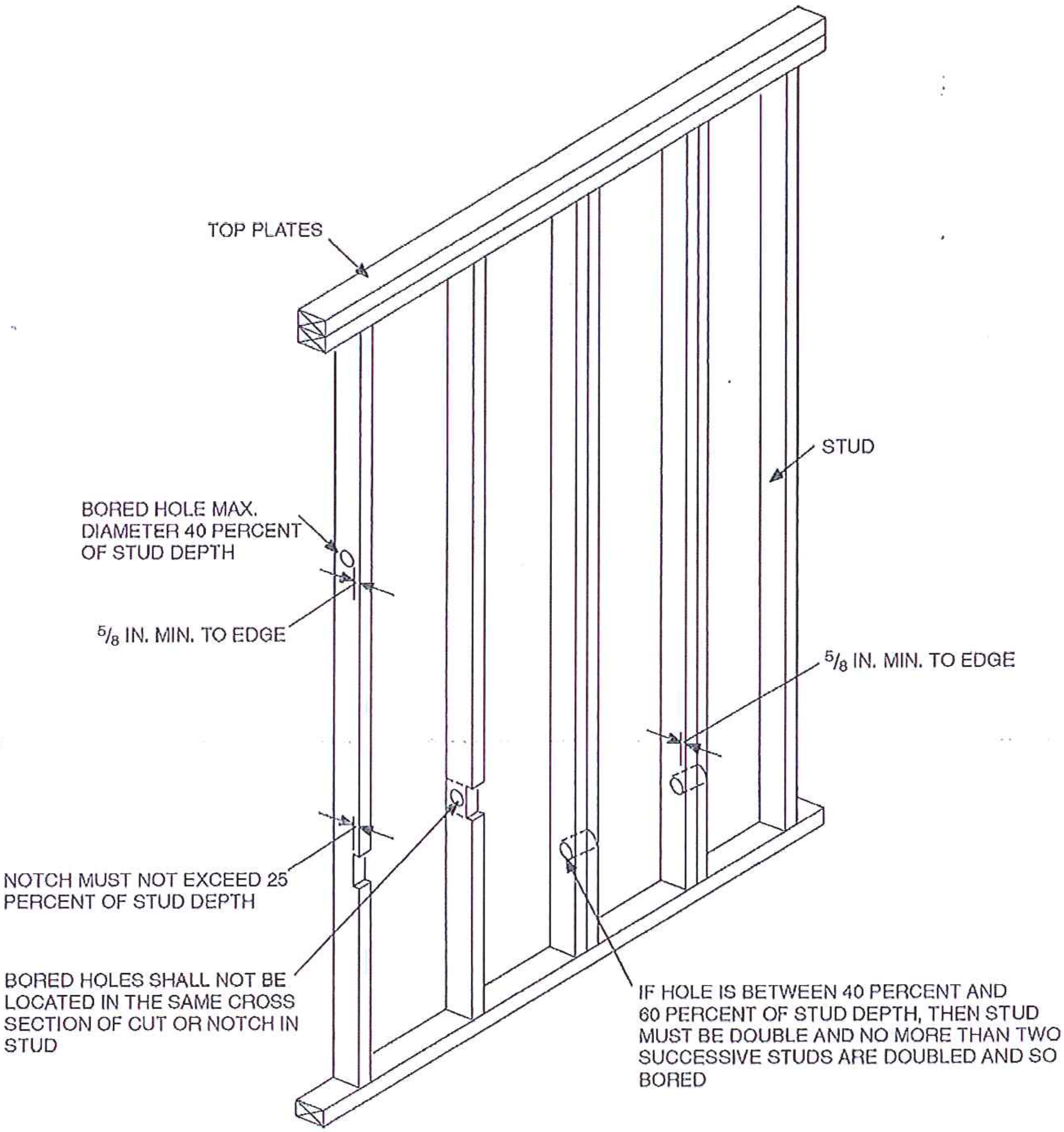
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Spans are given in feet and inches (ft-in).

b. Tabulated values are for No. 2 grade lumber.

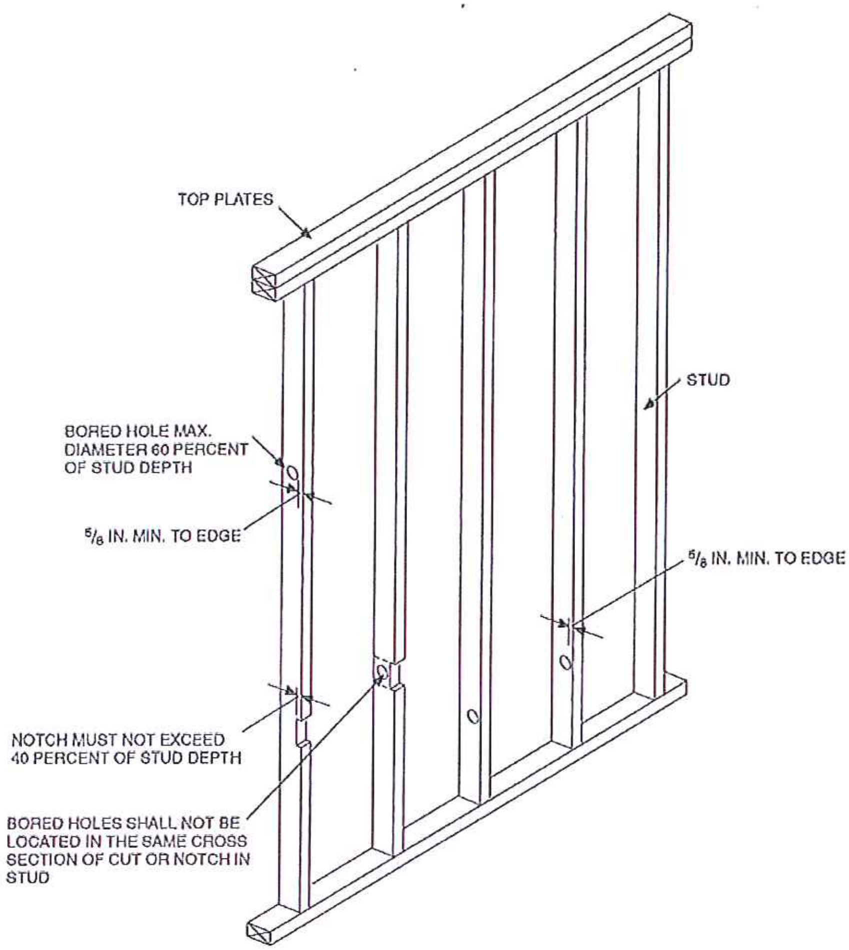
c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the headers are permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.



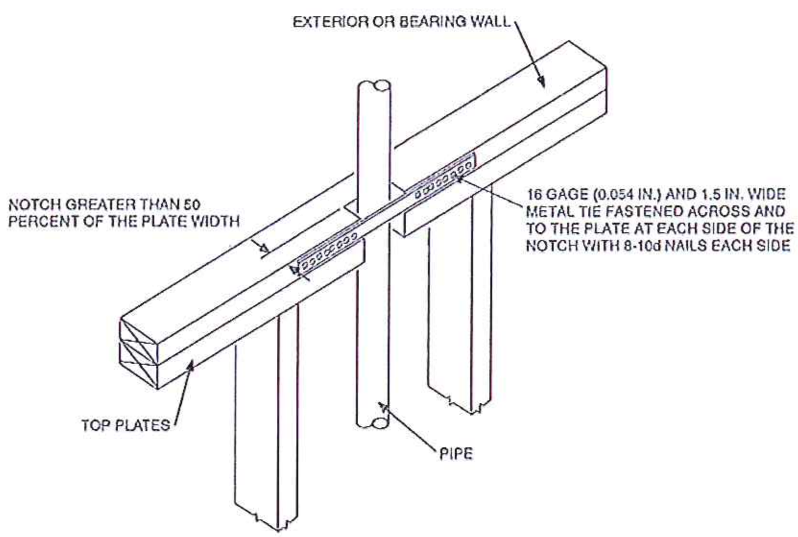
For SI: 1 inch = 25.4 mm.
Note: Condition for exterior and bearing walls.

FIGURE R602.6(1)
NOTCHING AND BORED HOLE LIMITATIONS FOR EXTERIOR WALLS AND BEARING WALLS



For SI: 1 inch = 25.4 mm.

FIGURE R602.6(2)
NOTCHING AND BORED HOLE LIMITATIONS FOR INTERIOR NONBEARING WALLS



For SI: 1 inch = 25.4 mm.

FIGURE R602.6.1
TOP PLATE FRAMING TO ACCOMMODATE PIPING

ters or trusses (including stories below top *story*) shall have the framing members connected in accordance with one of the following:

1. Fastening in accordance with Table R602.3(1) where:
   1.1. The basic wind speed does not exceed 90 mph (40 m/s), the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less, or
   1.2. The net uplift value at the top of a wall does not exceed 100 plf. The net uplift value shall be determined in accordance with Section R802.11 and shall be permitted to be reduced by 60 plf (86 N/mm) for each full wall above.
2. Where the net uplift value at the top of a wall exceeds 100 plf (146 N/mm), installing *approved* uplift framing connectors to provide a continuous load path from the top of the wall to the foundation or to a point where the uplift force is 100 plf (146 N/mm) or less. The net uplift value shall be as determined in Item 1.2 above.
3. Wall sheathing and fasteners designed in accordance with accepted engineering practice to resist combined uplift and shear forces.

R602.4 Interior load-bearing walls. Interior load-bearing walls shall be constructed, framed and fireblocked as specified for exterior walls.

R602.5 Interior nonbearing walls. Interior nonbearing walls shall be permitted to be constructed with 2 inch by 3 inch (51 mm by 76 mm) studs spaced 24 inches (610 mm) on center or, when not part of a *braced wall line*, 2 inch by 4 inch (51 mm by 102 mm) flat studs spaced at 16 inches (406 mm) on center. Interior nonbearing walls shall be capped with at least a single top plate. Interior nonbearing walls shall be fireblocked in accordance with Section R602.8.

R602.6 Drilling and notching of studs. Drilling and notching of studs shall be in accordance with the following:

1. Notching. Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25 percent of its width. Studs in nonbearing partitions may be notched to a depth not to exceed 40 percent of a single stud width.
2. Drilling. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no more than 60 percent of the stud width, the edge of the hole is no more than $^5/_8$ inch (16 mm) to the edge of the stud, and the hole is not located in the same section as a cut or notch. Studs located in exterior walls or bearing partitions drilled over 40 percent and up to 60 percent shall also be doubled with no more than two successive doubled studs bored. See Figures R602.6(1) and R602.6(2).

   Exception: Use of *approved* stud shoes is permitted when they are installed in accordance with the manufacturer's recommendations.

R602.6.1 Drilling and notching of top plate. When piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50 percent of its width, a galvanized metal tie not less than 0.054 inch thick (1.37 mm) (16 ga) and $1^1/_2$ inches (38 mm) wide shall be fastened across and to the plate at each side of the opening with not less than eight 10d (0.148 inch diameter) having a minimum length of $1^1/_2$ inches (38 mm) at each side or equivalent. The metal tie must extend a minimum of 6 inches past the opening. See Figure R602.6.1.

Exception: When the entire side of the wall with the notch or cut is covered by wood structural panel sheathing.

R602.7 Headers. For header spans see Tables R502.5(1), R502.5(2) and R602.7.1.

R602.7.1 Single member headers. Single headers shall be framed with a single flat 2-inch-nominal (51 mm) member or wall plate not less in width than the wall studs on the top and bottom of the header in accordance with Figures R602.7.1(1) and R602.7.1(2).

R602.7.2 Wood structural panel box headers. Wood structural panel box headers shall be constructed in accordance with Figure R602.7.2 and Table R602.7.2.

R602.7.3 Nonbearing walls. Load-bearing headers are not required in interior or exterior nonbearing walls. A single flat 2-inch by 4-inch (51 mm by 102 mm) member may be used as a header in interior or exterior nonbearing walls for openings up to 8 feet (2438 mm) in width if the vertical distance to the parallel nailing surface above is not more than 24 inches (610 mm). For such nonbearing headers, no cripples or blocking are required above the header.

R602.8 Fireblocking required. Fireblocking shall be provided in accordance with Section R302.11.

R602.9 Cripple walls. Foundation cripple walls shall be framed of studs not smaller than the studding above. When exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional *story*.

Cripple walls with a stud height less than 14 inches (356 mm) shall be continuously sheathed on one side with wood structural panels fastened to both the top and bottom plates in accordance with Table R602.3(1), or the cripple walls shall be constructed of solid blocking.

All cripple walls shall be supported on continuous foundations.

R602.10 Wall bracing. Buildings shall be braced in accordance with this section or, when applicable, Section R602.12. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with Section R301.1.

ORDINANCE NO. 96-2079-I

AN ORDINANCE AMENDING CHAPTER 82 OF THE CODE OF ORDINANCES OF THE CITY OF LA PORTE BY AMENDING CHAPTER 82 "BUILDINGS AND BUILDING REGULATIONS," ARTICLE II "BUILDING CODES", TO ADD A NEW SECTION 82-37 "MINIMUM SIZE STUD WALLS WHERE DRAIN, WASTE, AND/OR VENT PLUMBING IS INSTALLED" AND TO AMEND SECTIONS 82-37—82-65 "RESERVED"; PROVIDING A REPEALING CLAUSE; CONTAINING A SAVINGS CLAUSE; FINDING COMPLIANCE WITH THE OPEN MEETINGS LAW; PROVIDING A SEVERABILITY CLAUSE; PROVIDING THAT ANY PERSON VIOLATING THE TERMS OF THIS ORDINANCE SHALL BE DEEMED GUILTY OF A MISDEMEANOR AND UPON CONVICTION SHALL BE FINED IN A SUM NOT TO EXCEED TWO THOUSAND DOLLARS; PROVIDING FOR THE PUBLICATION OF THE CAPTION HEREOF; AND PROVIDING AN EFFECTIVE DATE HEREOF.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF LA PORTE, TEXAS:

Section 1. New Section 82-37 is hereby added to the City of La Porte Code of Ordinances Chapter 82 "Buildings and Building Regulations", Article II, "Building Codes", and shall hereinafter read as follows, to-wit:

"Section 82-37. Minimum size stud walls where Drain, Waste and/or Vent plumbing is installed.

Minimum six-inch (6") stud walls shall be required where drain, waste & vent (DWV – Horizontal and/or Vertical) plumbing is installed. The use of 2X6 studs (wood or metal) shall be required for new construction and additions (addition of square footage) for both residential and non-residential construction where DWV plumbing is installed."

Section 2. Sections 82-37—82-65, "Reserved", of City of La Porte Code of Ordinances Chapter 82 "Buildings and Building Regulations", Article II, "Building Codes", is hereby amended and shall hereafter read as follows, to-wit.

"Section 82-38—82-65. Reserved".

Section 3. All ordinances or parts of ordinances inconsistent with the terms of this ordinance are hereby repealed; provided, however, that such repeal shall be only to the extent of such inconsistency and in all other respects this ordinance shall be cumulative of other ordinances regulating and governing the subject matter covered by this ordinance.

Section 4. If any section, sentence, phrase, clause, or any part of any section, sentence, phrase, or clause, of this Ordinance shall, for any reason, be held invalid, such invalidity shall not affect the remaining portions of this Ordinance, and it is hereby declared to the intention of this City Council to have passed each section, sentence, phrase, or clause, or part thereof, irrespective of the fact that any other section, sentence, phrase, or clause, or part thereof, may be declared invalid.

Section 5. Any person, as the term "person" is defined in Section 1.07 (27), Texas Penal Code, who shall violate any provision of the ordinance, shall be deemed guilty of a misdemeanor and upon conviction shall be punished by a fine not to exceed TWO THOUSAND DOLLARS ($2,000.00).

Section 6. This Ordinance shall be effective sixty (60) days after its passage and approval. The City Secretary shall give notice of the passage of this ordinance by causing the caption hereof to be published in the official newspaper of the City of La Porte at least twice within ten (10) days after the passage of this ordinance.

Section 7. The City Council officially finds, determines, recites and declares that a sufficient written notice of the date, hour, place and subject of this meeting of the City Council is posted at a place convenient to the public at the City Hall of the city for the time required by law preceding this meeting, as required by the Chapter 551, Texas Government Code; and that this meeting has been open to the public as required by law at all times during which this ordinance and the subject matter thereof has been discussed, considered and formally acted upon. The City Council further ratifies, approves and confirms such written notice and the contents and posting thereof.

PASSED AND APPROVED this the 24th day of April, 2006.

CITY OF LA PORTE

By: Alton E. Porter
Mayor

ATTEST:

Martha Gillett
City Secretary

APPROVED:

Clark T. Askins
City Attorney