Masonry Wall Bracing

What Goes Up, Doesn't Have to Come Down

By Rashod R. Johnson, P.E.

"If God wants the wall, God will take the wall". The sooner owners, architects, engineers and contractors realize this simple fact, the easier masonry wall bracing becomes. The question that immediately comes to mind is, "What do we do in the meantime?" The answer to this question is found in a document developed by the Council for Masonry Wall Bracing and published by the Mason Contractors Association of America entitled, *The Standard Practice for Bracing Masonry Walls Under Construction*. This document gives architects, engineers, contractors and safety professionals guidance for developing a wall bracing plan. It is intended to make construction safe and does not address protection from property loss.

OSHA's "Adequate Bracing"

OSHA's mission is to assure the safety and health of America's workers by setting and enforcing standards; providing training, outreach, and education; establishing partnerships; and, encouraging continual improvement in workplace safety and health. This means that OSHA's primary goal is life safety. Given this focus, the Code of Federal Regulations (CFR) establishes the requirements for masonry construction as it pertains to life safety.

CFR 1926.706(b) simply states that "*all masonry walls over eight feet in height shall be adequately braced to prevent overturning and to prevent collapse unless the wall is adequately supported so that it will not overturn or collapse. The bracing shall remain in place until permanent supporting elements of the structure are in place*."

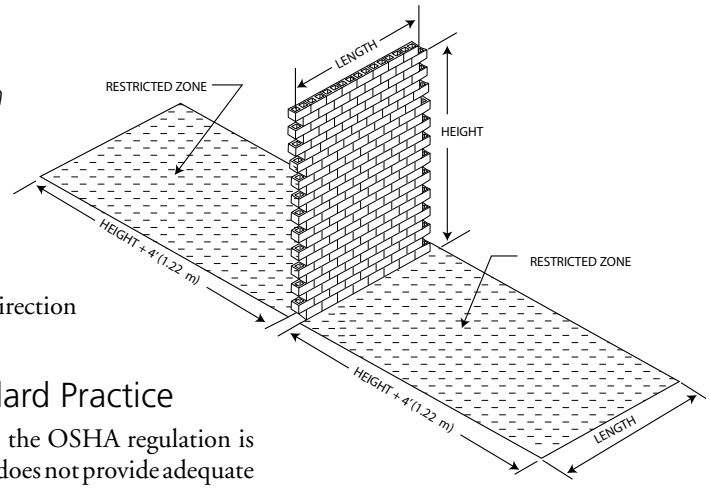
This leads to an obvious question: What is *adequate*?

Some OSHA compliance officers feel as though if the wall falls down, no matter how much bracing was installed, it was inadequate. Conversely, if the wall stands, no matter how little bracing was installed, it was adequate. This regulation is considered a "performance standard", which requires both the controlling employer (general contractor/construction manager) and the creating employer (mason contractor) to develop a plan to support the masonry wall. This places all of the liability upon the shoulders of the contractors, with minimal direction from OSHA.

Standard Practice

Unfortunately, the OSHA regulation is ambiguous and does not provide adequate methods for bracing. Therefore, in the spring 1997, the Mason Contractors Association of America (MCAA) decided to "standardize" the means and methods of bracing masonry walls. In order to achieve this goal, the MCAA sought the help of masonry industry experts by forming the Council for Masonry Wall Bracing. The Council consisted of contractors, structural engineers and other masonry design professionals and a representative from OSHA. The Council conducted research and, from the data, developed a standard set of guidelines to show the contractor where typical masonry walls needed to be braced. As a result, in July 1999, the *Standard Practice for Bracing Masonry Walls Under Construction* was published. This new *Standard Practice* was the first industry-supported document giving specific procedures for bracing masonry walls during construction. The goal of this *Standard Practice* was to provide life safety for masons and other workers on a construction site during the time when a masonry wall is being constructed. The *Standard Practice* was updated in 2001 and is currently being updated for 2008.

The Council for Masonry Wall Bracing recognizes that it is impossible to prevent the collapse of a masonry wall during construction and that life safety is the primary concern. The *Standard Practice* has a procedure whereby the wall and area around the wall is evacuated at a prescribed wind speed. Although many insurance companies may not agree with this approach, it reaches the goal of preserving the safety of all workers around a masonry jobsite. This means that if a wall falls inside of the limited access zone after it was evacuated, the wall bracing was adequate – adequate enough to ensure that no workers were injured or close to being injured.



Restricted Zone for Masonry Walls.

Masonry construction is drastically different from other forms of construction. For example, when precast and tilt-up walls are erected, they have the majority of their final design strength and can resist most wind loads. However, masonry walls are subjected to wind loads before the final design strength is achieved. This means that masonry walls can fall down under less severe wind conditions. This being the case, the Council needed to determine what the wind speed was at which the mason's safety was being compromised.

After testing, data indicated that masonry walls started to severely alter their shapes when wind speeds approached 60 miles per hour. Testing also showed that wind speeds at that level limited the ability of mason to accurately place the masonry unit, especially when on scaffolding. Therefore, it was agreed upon by the Council that the wall bracing in the *Standard Practice* be designed to resist a wind speed of 40 mph and evacuated at 35 mph. Once evacuated, a restricted zone was established where no worker was allowed until the winds had slowed down. This would keep the *Standard Practice* in line with both OSHA and MCAA's goal of protecting the mason and other workers.

There was a very specific scope that the *Standard Practice* covered that received OSHA acceptance.

The *Standard Practice*:

- provides an acceptable level of life safety for masons and others working on the construction site;
- provides requirements for evacuation of a restricted zone on either side of braced masonry walls and walls being constructed subjected to wind loads during construction resulting from specified wind speeds;

- provides design procedures for temporary bracing of masonry walls to resist wind loads during construction resulting from specified wind speeds or other wind speeds selected by the bracing system designer to reflect local wind conditions;
- provides for alternative bracing design and alternative means of providing for life safety; and
- does not address protection from property loss. If property loss protection is required, the level of protection is generally based upon a business decision by the masonry contractor.

While life safety is the obvious benefit of the *Standard Practice*, there are some other advantages that should be mentioned. The Mason Contractors Association of America (MCAA) has been in discussions with OSHA for years concerning the possible adoption of the *Standard Practice*. While OSHA would never "adopt" a standard practice, they recognize its value and often refer interested parties to the book for guidance. The MCAA, along with the Laborers' (AGC and the Laborer's Health and Safety Fund of North America) sponsors a masonry "best practices" seminar for OSHA compliance officers throughout the country, where they are taught wall bracing using the *Standard Practice*. Therefore, if OSHA were to visit your job site and you are following the *Standard Practice*, you will most likely not be cited or fined because, in many cases, they recognize this as the "industry standard".

Who's "In the Zone"?

OSHA Regulation **CFR 1926.706(a)** states:

"A limited access zone shall be established whenever a masonry wall is being constructed. The limited access zone shall conform to the following:

- *The limited access zone shall be established prior to the start of construction of the wall.*
- *The limited access zone shall be equal to the height of the wall to be constructed plus four feet, and shall run the entire length of the wall.*
- *The limited access zone shall be established on the side of the wall which will be unscaffolded.*
- *The limited access zone shall be restricted to entry by employees actively engaged in constructing the wall. No other employees shall be permitted to enter the zone.*
- *The limited access zone shall remain in place until the wall is adequately supported to prevent overturning and to prevent collapse unless the height of wall is over eight feet, in which case, the limited access zone shall remain in place until the requirements of paragraph (b) of this section have been met."*

The *Standard Practice* refers to the limited access zone as the Restricted Zone. A mason contractor who's thinking ahead will designate the Restricted Zone area early in the construction schedule based on what the total, completed height of the wall will be when finished. This way, he or she can avoid setting up caution tape and then later having to move it. For example, if a wall will be built to a height of 24 feet, the restricted zone should be set up at 28 feet as soon as the wall reaches 8 feet in height. Without the proper planning, the area would have to be cautioned off at 12 feet when the wall becomes 8 feet high, and moved out as the wall gets higher. This is a waste of time, resources and ultimately, money.

Initial vs Intermediate Period

The initial period is defined as "*the period of time, limited to a maximum of one working day, during which the masonry is being laid above its base or the highest line of bracing and, at the end of which, required bracing is installed.*" In layman's terms, this is the period in which the masonry is still in its initial stage of curing (usually 8 to12 hours after wall is built). The *Standard Practice* states that during the initial period, masonry work is allowed to continue as long as wind speeds do not exceed 20 miles per hour.

During the initial period of construction, only those employees who are actively working in a manner that is pertinent to the construction of the wall are allowed in the Restricted Zone. This includes any of the mason contractor's employees or, let's say, an electrician who is responsible for putting conduit in the wall as it is being built. A plumber installing water lines next to the wall is not pertinent to the construction of the wall, therefore he or she would not be able to install those lines in the Restricted Zone during the initial period of construction.

The intermediate period is defined as "*the period of time following the initial period until the wall is connected to the elements that provide its final lateral stability from supporting structural elements.*" This is usually the time following the initial period until the wall is connected to structural frame elements, floors, roofs, or is "adequately internally braced". Cross walls and pilasters can also serve as stability so as to allow braces to be removed at those locations. During the intermediate period, the Restricted Zone must be evacuated at wind speeds of 35 miles per hour or higher.

Wall Bracing Materials

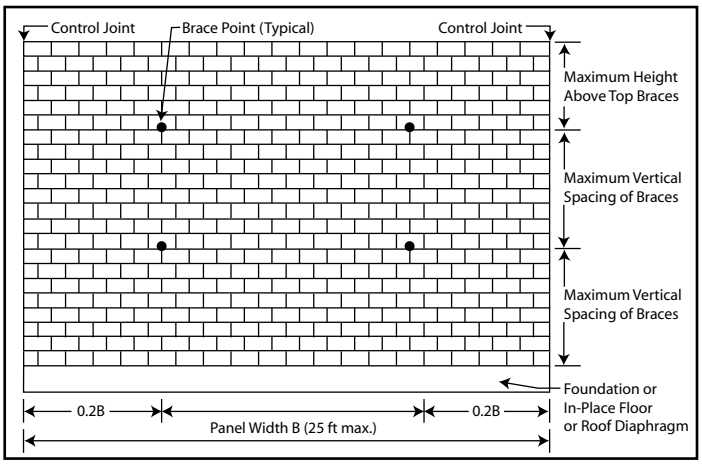
While there are many different types of wall bracing available in the marketplace, the *Standard Practice* recognizes three basic types: pipe bracing, cable bracing and wooden bracing. While none are endorsed, it should be noted that, in most cases, pipe bracing provides a more consistent resistance to wall and wind loads than cable and wooden bracing.

Basics of Wall Bracing Design

When bracing masonry walls, there are some basic rules that must be followed in order to meet the goal of stabilizing the wall for the purposes of worker safety. For example, a minimum of two braces is required per wall panel (the distance between control joints). Using two braces per panel is important because, with only one brace per panel, the wall can become unstable at higher wind speeds. Standard industry recommendations allow a length of wall between control joints of approximately 25 feet for concrete and clay masonry units. A good rule of thumb is to encourage your architect to place control joints at 24 feet 8 inches apart to allow standard 8x8x16-inch block to be laid out to that distance without the need for cutting.

Braces must be installed with 20% of the wall outside of each brace at the control joint. The easiest way to figure this is to take the panel length and multiply by 0.2. For example, a 25-foot long wall multiplied by 0.2 would leave each brace located at 5 feet from the control joints and 15 feet between the braces.

Bracing heights vary based on which period of construction the



1. For maximum height above braces see Table 4.2 for initial period requirements or Table A.1 for intermediate period.
2. For maximum vertical spacing of braces, see Table A.1.
   Note: Walls shall be considered unreinforced until grout has been in place at least 12 hours.

Bracing spacing requirements for Table A.1

Table 4.2 Maximum Unbraced Height of Masonry Walls Above Grade or Highest Line of Lateral Support						
	Density of Masonry Units, (y) (lb/ft³)					
	95 < y < 115		115 < y < 125		125 < y	
Nominal Wall Thickness (Inches)	Ungrouted Hollow Units	Solid and Fully Grouted Hollow Units[2]	Ungrouted Hollow Units	Solid and Fully Grouted Hollow Units[2]	Ungrouted Hollow Units	Solid and Fully Grouted Hollow Units[2]
4	8' 0"	8' 0"	8' 0"	8' 0"	8' 0"	8' 0"
6	8' 0"	8' 0"	8' 0"	10' 0"	8' 0"	10' 6"
8	10' 8"	15' 4"	12' 8"	18' 0"	14' 0"	20' 0"
10	16' 8"	24' 2"	20' 0"	29' 2"	21' 8"	31' 8"
12	23' 0"	35' 0"	28' 0"	35' 0"	30' 0"	35' 0"

[1] For partially grouted masonry, weight of masonry shall be determined on the basis of linear interpolation between hollow units that are ungrouted and those that are fully grouted, based on the amount of grouting.
[2] Solid units may have up to 25% coring.
[3] This table is for 20 miles per hour wind speeds. For wind speeds greater than 20 miles per hour, see Table A2.1 - A2.5.

wall is in, the density of the units being installed and the method of grouting. For example, if the mason is utilizing a high lift grouting technique, the wall is considered unreinforced until the grout has been placed and cured for at least 12 hours. Once the grout in the wall has cured for a minimum of 12 hours, the masonry wall enters into the Intermediate Period and lower braces can be moved up based on the *Standard Practice*.

Monitoring Wind Speed

There are a number of ways to measure the wind speed on a jobsite. The most accurate and efficient way is a small digital instrument called an anemometer. Anemometers cost between $80 and $200, and are well worth the investment. The more advanced instruments can be programmed to sound an alarm when the established wind speed is exceeded. This makes wind monitoring extremely easy and accurate.

If these instruments are not onsite, the visual method of measuring wind can be used, provided that site personnel can measure visually based on the Beaufort Wind Scale (BWS). However, if this visual method to measure is used, evacuation times change due to the decrease in accuracy of the visual method.

The BWS method may sound crazy, but it works. When compared to actual wind instruments, it is amazing how close you can determine the wind speed.

If you are using the BWS method and an OSHA inspector comes on the job site, be sure the Responsible Person – the person who has been trained on how to set up and monitor wall bracing, maintain the Restricted Zone, as well as monitor wind speed – makes them aware that you are measuring the wind using this method.

Plan your Brace and Brace your Plan

There are two key elements to a masonry wall bracing plan: the notification criteria and the detailed bracing locations. The notification criteria is all about communication, communication and communication. Detail a plan that will indicate who on the jobsite is responsible for the erection and dismantling of the bracing, monitoring the wind speeds and establishing the restricted zones. Also identify who has the authority to supervise all trades that may be working on or near the wall, and communicate the plan. This will reduce jobsite misunderstandings between various trades working in the same areas.

Bracing locations should be planned before the wall is built, making the entire bracing sequence safer and more cost efficient.

FAQ on Wall Bracing

Many contractors, both masonry and general, are cited every year by OSHA for inadequate masonry wall bracing. While some citations may be warranted, others are not. The following are common questions concerning masonry wall bracing.

Q: Do all masonry walls need bracing?
A: 29 CFR 1926.706 states all walls over 8 feet must be adequately braced. However, in an OSHA letter of interpretation from 1996, OSHA recognizes that some walls may be designed to take construction loads. If this is the case, the employer (the contractor) needs to determine if the wall is capable of withstanding construction forces and does not need bracing. If this is so, the contractor needs to substantiate this claim.

Q: Does brick veneer need to be braced?
A: It depends on the type of construction. If the brick veneer is tied to an existing structure (i.e. wood stud, steel stud, and cmu backup), the veneer does not have to be braced. However, if the cmu and brick are being built simultaneously, then one side of the composite wall should be braced.

Q: Do both sides of the wall need to be braced?
A: No. There are different types of wall bracing systems that allow for varying bracing methods. Some bracing consists of a compression style of bracing that needs to be placed on both sides of the wall. Other types consist of a steel connector that goes through the wall, allowing the use of a dead man to withstand multi-directional wind loads.

Q: Does the limited access zone need to be on both sides of the wall?
A: No. 29 CFR 1926.706 (a) (3) states that the limited access zone shall be established on the side of the wall that will be unscaffolded.

Q: Can scaffolding act as wall bracing?
A: No. Scaffolding in most cases is designed to be tied to the structure. Therefore, it cannot withstand any wind loads.

Q: Where can I get the *Standard Practice for Bracing Masonry Walls Under Construction and the Masonry Wallbracing Handbook?*
A: The Mason Contractors Association of America at **www.masoncontractors.com** or by phone at (847) 301-0001.

This will allow the contractor to mark the limited access zone, and to plan through-wall connections and cut-outs for veneer and insulation.

Once this bracing plan is developed, it should be communicated with the subcontractor, general contractor and construction manager to ensure that all are on the same page. This can usually occur at the pre-construction meeting for the masonry.

Conclusion

Bracing masonry walls are often thought of as means and methods, and rarely seen as important until a wall is blown down. In many cases, masonry wall bracing should probably be designed by a licensed engineer. However, since its seen as means and methods, *The Standard Practice for Bracing Masonry Walls Under Construction* offers contractors and engineers with a very easy-to-read manual that will allow masonry wall bracing to be installed correctly and safely to contribute to the life safety of every worker near that masonry wall. For more information about the Standard Practice for Bracing Masonry Walls Under Construction, visit the Mason Contractors Association of America website, **www.masoncontractors.org**.▪

Beaufort Number	Wind Speed	Effects on Land
0	Calm	Smoke will rise vertically.
1	1-3	Rising smoke drifts, weather vane is inactive.
2	4-7	Light Breeze: Leaves rustle, can feel wind on your face, weather vane is inactive.
3	8-12	Gentle Breeze: Leaves and twigs move around. Lightweight flags extend.
4	13-18	Moderate Breeze: Moves thin branches, raises dust and paper.
5	19-24	Fresh breeze: Trees sway.
6	25-31	Strong Breeze: Large tree branches move, open wires (such as power lines) begin to "whistle", umbrellas are difficult to keep under control.
7	32-38	Moderate Gale: Large trees begin to sway, noticeably difficult to walk.
8	39-46	Fresh Gale: Twigs and small branches are broken from trees, walking into the wind is very difficult.

Beaufort Wind Scale.

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