DOWNLOAD PDF STANDARD PRACTICE FOR BRACING MASONRY WALLS DURING CONSTRUCTION

Chapter 1 : PE Design Stardards : engineering

Standard Practice for Bracing Masonry Walls Under Construction D The Standard Practice for Bracing Masonry Walls Under Construction was developed to provide mason contractors, general contractors, architects and engineers with a detailed definition of adequate bracing for masonry walls.

IMUA was organized in as a national trade association and rating bureau for all inland marine classes. Today, IMUA is comprised of -- Members - insurance and reinsurance companies that underwrite a significant portion of the commercial inland marine insurance in the U. IMUA is committed to advancing the educational, governmental, regulatory and technical interests of the commercial inland marine insurance industry. One of the services IMUA provides its members is the publishing of information for use by underwriters, loss control and claims specialists, and other interested parties. The topics covered by IMUA Reports, Bulletins and News Articles are intended to provide an overall awareness of the issues, hazards and exposures associated with a specific industry or inland marine class of business. Committee members abide by antitrust restrictions while compiling information. No warranties are made regarding the thoroughness or accuracy of the report or any part of it. Nothing in this report should be interpreted as providing definitive guidance on any question relating to policy interpretation, underwriting practice, or any other issues in insurance coverage. IMUA does not prescribe to its members how to make underwriting or claims decisions, nor does it require that analysis follow any particular format. IMUA offers thanks and appreciation to the committee members for their contribution to this report: However, the topic of temporary wall bracing, particularly as respects to wind and masonry walls, was deemed to be of such importance that the Committee felt a separate report on the topic was warranted. A Caveat - Please do not confuse masonry wall bracing with pre-cast tilt-up wall bracing. Masonry wall construction involves a very dynamic job site process requiring proper planning where on-site processes are critical to reduce the potential of wall collapse. This paper is not intended to be a design guide or standard, nor does it replace the need to use qualified engineers to design specific bracing systems in accordance with industry standards, local codes and best practices. This paper utilized recommendations contained in a loss prevention guide obtained from the former Kemper Insurance Companies as its framework. Please note that there are two Addendums - in Word format - enabling a loss prevention specialist to download either section and type free-form comments in the designated boxes, thus permitting customization for each client. Who is responsible for developing the bracing plan? Last minute decisions at the job site are not considered an acceptable method of temporary wall bracing. A professional engineer should be responsible for the proper design of the bracing system in advance of this phase of the project. What standard or code is used to design the bracing system? This standard was published for the first time in and is gaining industry acceptance. The scope of this document is to provide an acceptable level of life safety for masons and others working on the construction site. Copies of the standard can be obtained from the Mason Contractors Association of America. What wind speed is used to design the bracing system? The wind speed used in the Standard Practice for Bracing Masonry Walls Under Construction - Council for Masonry Wall Bracing is not intended to prevent the wall from collapsing from wind loads in excess of about mph. Remember the main goal of this standard is life safety not property protection. The bracing system should be designed to withstand the normally expected wind speed that may occur during the construction project, and the wind load must be evaluated from either side of the wall. Since local wind conditions must be considered, local officials, building codes and other reference sources should be consulted when selecting the proper design wind speed. Because of these issues, one should see the importance of using a professional engineer for this important issue. Contractors should choose masons based on a consistent safety qualification process. The OSHA record of accidents should be part of the proposal. Is there a procedure in place to ensure that the bracing system design is properly implemented at the job site? To ensure proper execution at the job site of the design specifications, a checklist should be developed by the bracing system designer, and used by the contractor on a daily basis to

ensure proper installation of the bracing system. Who should manage the bracing installation process at the job site? This ese individual s should have clearly defined responsibilities to ensure the bracing system is installed properly, safely and is well maintained. Equipment and materials should not be stored within the Restricted Zone with the exception of materials being used to construct the wall. The Restricted Zone is defined as - The area on either side of a wall subject to the effect of a masonry wall collapse, measured by a horizontal distance equal to the height of the constructed wall plus 4 feet, measured at right angles to the wall, and continuing for the length of the wall. How will the contractor monitor the wind speed at the project site as required in the Standard Practice for Bracing Masonry Walls Under Construction? A wind speed indicator, equipped with an annunciator audible alarm , should be used at the project site. The annunciator sounds an alert that the wind speed has reached a pre-set threshold, whereby action is needed to protect workers. How will the contractor address the lateral and vertical forces acting on the braces, anchors, deadman, and attachments? When the wind exerts pressure against the wall bracing system, it is subject to lateral and other forces that attempt to push, pull, drag, lift, compress, and slide the components. Design efforts must account for all of these forces, and special care must be given to situations where bracing is only installed on one side of the wall. When wood or steel bracing is used on only one side of the wall it must be adequatel designed and securely connected to the wall. Cable bracing should never be used only on one side of the wall, since it does not resist compression forces. What are the limitations of some of the anchor types? Steel reinforcing rods rebar are not an acceptable method of anchoring. Steel rods offer very little lateral or up lift resistance. Wooden stakes in conjunction with one-sided bracing systems is not an acceptable method of anchoring. Wooden stakes offer very little up lift resistance. Project supplies or materials should not be used as above ground deadman. Without realizing it sub contractors may begin to remove these items, resulting in a reduction in the ability of the deadman to resist uplift or sliding forces. How will the bracing system design be modified if the project will involve movement joints control joints greater than 25 feet? When movement joints greater than 25 feet are planned, it may be necessary to provide more than two braces per panel. The bracing system design engineer should be consulted about this issue. Will the masonry wall construction be conducted during periods of cold weather? Will the project involve the use of high-speed scaffolding? Traditional scaffolding methods involve the use of 6 feet high metal sections that were erected as the masonry wall was constructed. This resulted in normal delays while the scaffolding was raised to the next level, thus restricting the amount or height of wall that could be constructed in one day. High-speed scaffolding allows the mason to work virtually non-stop, creating a situation where bracing may be needed before the end of the workday. The bracing system designer should be consulted regarding this issue. Will the project involve the use of high lift grouting? Just like mortar, grout must hydrate, and until such time adds no bonding strength to the wall system. High lift grouting is the technique of grouting masonry in lifts for the full height of the wall. Low lift grouting is the technique of grouting as the wall is constructed, which tends to add strength sooner than high lift method. Historically Low lift grouting is common practice. If high lift grouting is used then the bracing system design should be based on a non-reinforced wall, especially during the initial period. The bracing system designer should be consulted about this issue. Will the wall incorporate reinforcement rods within the masonry unit cavities? Depending on the design specifications, reinforcement rods may be added to impart additional strength to the wall, sometimes only after the grout hydration process has occurred. When this procedure is used, the wall is often treated as an unbraced masonry wall especially for at least the first 24 hours , and the bracing system should be designed accordingly. Are knee braces being proposed in the bracing system plan? If knee braces are used, lateral braces should also be used. When will the mason install the required initial period bracing? Initial period bracing must be installed before leaving the site at the end of the workday, or sooner if the wall has reached the unbraced height limitation. It is not acceptable to wait until the next workday to install the required bracing. How long should a bracing system be kept in place? The braces or any of their components should not be removed until the masonry wall is laterally supported by permanent structural connections. How can one detect if the bracing system connection and attachment points work loose? A

periodical inspection of the bracing system components should be completed during the life cycle of the bracing system. These inspections should be documented on a written inspection log and retained for possible future review by the underwriting or loss control staff. A professional engineer or other qualified individual must be responsible for the proper design of the bracing system. What standard s or code s are being used to design the bracing plan? To purchase a copy of the guideline or obtain additional information please contact the Tilt-Up Concrete Association. What wind speed is being used to design the bracing system? Local building officials and weather stations should be consulted when selecting the proper design wind speed, because of variances in local conditions that may affect the actual wind speeds at the project site. Does the contractor have a procedure in place to ensure that the bracing system design is properly implemented at the job site? A checklist should be developed by the bracing system designer and used by the contractor to insure proper installation of the bracing system. Who is managing the bracing installation process at the job site? The contractor should designate a Responsible Person to manage project site responsibilities with regards to bracing. Who is supplying your bracing system materials? A trained and certified dealer should supply the bracing system components. Their expertise in component selection, allowable loads, and safety factors is important. Will the crane operator be able to see the entire panel lifting and placement process? How will the contractor address the lateral and vertical forces acting on the braces, anchors, dead men, and attachments? When the wind exerts pressure against the wall the bracing system is subject to lateral forces that attempt to push, pull, drag, lift, compress, and slide the components. When wood or steel bracing is used on only one side of the wall it must be adequately designed and securely connected to the wall and deadman. Cable bracing should never be used on only one side of the wall, since it does not resist compression forces. What type of anchors will be used to connect the brace to the deadman?

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Chapter 2 : Free reference book - Construction Exam - Engineer Boards

Standard Practice for Bracing Masonry Walls Under Construction, Pass the Civil Professional Engineering (PE) Exam Guide Book (Third Edition), bring up a PDF file with information on how to navigate and use this course.

Mortar shall be mixed and shall be selected in accordance with the proportion specification prescribed. Shims shall be corrosion-resistant metal or plastic with a required minimum compressive strength. Courses of concrete masonry units between the leveling courses shall be placed without mortar on the bed or head joints. Place units in running bond. Remove burrs and butt blocks tightly. Use shims, mortar, or surface bonding mortar to plum and level individual units when necessary. Use clean mixing equipment and water free of deleterious amounts of acid, alkali, and organic materials. Mix only full bag multiples of material to overcome any segregation of ingredients. Mixing time shall be kept to a minimum, as over mixing may cause damage to the fibers. Before applying surface bonding mortar, wet the wall uniformly with water to prevent excessive suction of water from the surface bonding mortar. Trowel- or spray-apply surface bonding mortar to both sides of dry-stacked concrete masonry units. When a second coat of surface bonding mortar is to be applied, the first coat shall have taken its initial set. Dampen the wall with a water mist after a specified time, but within a day of application of surface bonding mortar. The top of the walls shall be covered with a nonstaining, waterproof covering to prevent moisture from entering the wall until the top is permanently protected. This abstract is a brief summary of the referenced standard. It is informational only and not an official part of the standard; the full text of the standard itself must be referred to for its use and application. ASTM does not give any warranty express or implied or make any representation that the contents of this abstract are accurate, complete or up to date. It does not include grout, reinforcing, anchorage, or control joints since their use is essentially the same as conventional concrete masonry construction, unless specifically mentioned in this practice. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

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Chapter 3 : Must Have With You | Learn Civil Engineering

Bracing masonry walls under construction requires predictable capacity to resist defined loads that may occur due to wind during construction and before the wall's final lateral support is in place.

May, By Diane Throop, P. It has been successfully applied in numerous projects with short to very tall walls. Bracing, in general, provides life safety for workers and other occupants on the job site, essentially keeping the wall up during construction and long enough to provide time for evacuation during a wind event. Protection of property, including the wall or walls under construction, is not the purpose of the bracing â€¦ although additional design considerations such as utilizing higher or even occupancy design level wind speeds may lead to bracing effective at accomplishing property protection as well. Internal bracing provides an excellent option to accomplish these goals. Internal Bracing provides verifiable engineering capacity and performance similar to, and in many cases better than, systems that incorporate external bracing components. Figure 1 shows a cantilevered wall with two base doweling conditions that influence the ability of a wall to perform as internally braced. The center diagram shows a common pinned base condition where the foundation dowel extends only 6 inches into the base of the masonry wall. This condition will provide only minimal capacity before the dowel embedment in the masonry fails and the wall becomes pinned at the base leaving only self-weight to resist over-turning. The right side diagram shows a wall with a 2. This wall will develop cantilevered capacity as the grout cures and then the wall performs with base fixity and moment continuity. Make sure the structural reinforcement is sized and spaced properly, and that wall is internally braced! The Basics Restricted Zone Beyond wall and brace capacity, the other key aspect of masonry bracing is the creation of a Restricted Zone. Because the bracing is typically engineered to resist wind speeds as specified in the Standard, which are lower than those required in the International Building Code, the Restricted Zone protects persons from serious injury or death by defining an area to be evacuated in the event of mandated wind speeds and prior to a partial or complete wall failure. That time period is broken into two distinct phases: The Initial Period and the Intermediate Period. There are different design requirements and restrictions for each. The Intermediate Period is defined as being the period of time following the Initial Period until the wall is connected to the elements that provide its final lateral support. That can be interpreted as being the period starting when the masonry is more than a day old until the wall is connected to a diaphragm or other elements that are sufficiently capable of transferring lateral force from the wall through other elements to the foundation. Each project condition should be evaluated independently to determine when the Intermediate Period ends. Materials Masonry Assemblies Masonry Assemblies â€" Reinforced masonry walls are the best candidates for internal bracing. This article focuses on low pour and low lift heights to generate capacity at the base of the cantilevered wall, although there are ways to use internal bracing with high lift and high pour heights or with unreinforced masonry both the Standard and the Internal Bracing Guide offer guidance. Pour height refers to the masonry wall height that is constructed prior to grout placement. Limiting the ungrouted wall height as the construction progresses by using low-pour heights takes advantage of strength that develops very quickly in constructed masonry and uses that strength, along with connection to the foundation, to internally brace the wall without an external brace system. Reinforced walls are the best candidates for application of Internal Bracing principles due to the significant strength that the reinforcement can add as the grout cures. If the wall reinforcement is properly doweled to the foundation, base fixity can create the desired cantilevered performance typically within 12 to 24 hours after grout placement. Analysis must consider axial and flexural tension and compression, as well as global over-turning. The bracing engineer must know the unit size and properties, unit weight, net area unit compressive strength, and mortar type and placement, and especially the reinforcement bar size and spacing to be used in construction. Reinforced masonry walls have been internally braced for heights in excess of sixty feet, and design engineers are often open to modifying bar sizes, spacing and even foundation dowel lengths. Foundation and Soils Foundation

analysis and, more specifically, soil capacity analysis can significantly impact the ability to use Internal Bracing. Recognizing that the demand placed on foundations is short term, only during the braced period, allows a more generous foundation evaluation: Higher allowable bearing pressures should be utilized, and consideration be given to passive and active pressure for providing resistance to sliding and rotation. Safety factors on bearing pressure are often in the range of 3. A common approach for bracing foundation evaluation is to take the reported allowable bearing capacity, multiply it by 3. Internal Bracing Analysis Initial Period Analysis During the Initial Period, the mortar, and grout where applicable, has not gained sufficient strength to resist load. Walls have only their self-weight available to resist overturning and flexure. As noted above, masonry walls are not considered to be braced during the Initial Period. The Standard contains two provisions: Evacuate the Restricted Zone whenever the wind speed exceeds 20 miles per hour, and the height of masonry above the base or highest line of support shall not exceed that shown in tables in the Standard. A bracing plan should incorporate height limits for all new masonry based on the Initial Period requirements. Intermediate Period Analysis Advantages of internally braced masonry walls become apparent during the intermediate period. Masonry walls can spend a significant amount of time in the Intermediate Period, depending on when diaphragms and the final lateral system are fully implemented. During the Intermediate Period, the Restricted Zone must be evacuated when the wind speed exceeds 35 miles per hour. That evacuation wind speed, coupled with a design wind speed of 40 miles per hour, provides a time and load buffer to facilitate evacuation. The primary focus of Internal Bracing is bracing to resist wind load during the Intermediate Period. Reinforced masonry analysis for Internal Bracing design can be achieved through hand calculations, and spreadsheets or software solutions. Most software packages allow the masonry net area compressive strength to be set by the user so the appropriate value can be entered for the Intermediate Period. Because the steel can be fully developed once the grout has cured for 12 to 24 hours, no change is needed for the tension portion of the analysis. The Internal Bracing Guide provides detailed examples. Internal bracing design philosophy is based on the masonry code and basic principles of mechanics, so bracing design should start with the reinforcement denoted in the construction drawings. For example, allowable stress analysis can be conducted using Equation 9. Those limiting equations become, respectively: With a little work to find k and j, the analysis can be easily completed. Option to Eliminate Restricted Zones Eliminating the Restricted Zones can be done but requires the use of design level wind speeds and higher lateral pressures. More significant masonry reinforcement and foundations typically result and their cost must be considered when evaluating bracing concepts. Internal Bracing Plan Once an Internal Bracing scheme has been evaluated and designed, it is important to properly and fully represent that design through verbal and graphic documentation. Such documentation provides the field staff with explicit information regarding sequencing of construction and Restricted Zones, as well as foundation, masonry and reinforcement requirements. Those same documents also provide opportunities for review by the prime contractor and designer of record. The bracing documentation also provides supplemental information for Special Inspectors to use as the basis for their inspections. Written Content One key element of an Internal Bracing plan is the written portion, which provides the base assumptions and requirements represented graphically in drawings or, for simple projects, may provide the entire bracing plan. The content should include material properties, foundation and soils criteria, masonry construction sequencing and any assumptions relative to surrounding construction or site sequencing that were utilized in the bracing design. Graphic Content The other portion of a bracing plan is the graphic content. For Internal Bracing this may simply be the foundation, and possibly framing plans, showing the walls and identifying the Restricted Zone. The plan s should include basic dimensions, notes regarding sequencing of the masonry construction and Restricted Zone implementation. Additional content could include ground and wall sign locations, control joints and walls used to buttress horizontal spans. Elevations, sections, and details can also be used to show important information, especially with regard to areas around openings and other points of discontinuity in the masonry. Proposed and accepted changes to the construction drawings also must be clearly represented in the bracing plan. Suggested bracing plan content is shown in Figure 2 and sample graphics, notes and a legend are

shown in Figure 3, to illustrate some of the requisite items as utilized for this particular project. Sample bracing plan graphics, notes and legend. Conclusion Masonry walls must be braced while they are under construction to provide safety to construction workers and other persons that may occupy the space adjacent to those walls. The Standard provides the engineering basis for analyzing bracing methods for masonry walls under construction, and the Internal Bracing Guide offers more detailed instruction on designing internal bracing. Internal bracing utilizes the strength provided by the wall as it is being constructed, without relying on external components. Cooperation with, and collaboration between, bracing design engineers, mason contractors and controlling contractors or construction managers are critical, and can yield highly efficient Internal Bracing schemes with significant benefit to projects in terms of safety, schedule and cost. Figures 4 and 5 show two projects that utilize internal bracing. What is striking is the absence of external bracing on both projects. Figure 5 shows a well-organized construction site that can lead to greatly improve site safety. Masonry walls under construction utilizing internal bracing. The Internal Bracing Guide is a document developed by IMI for engineers and other qualified persons designing masonry internal bracing systems. The Internal Bracing Guide applies the content of the Standard and other documents, along with knowledge gained through experience, to provide users with one approach to designing internally braced masonry walls. The Standard is an industry standard prepared by masonry professionals under the voluntary umbrella group called the Council for Masonry Wall Bracing. As masonry is often site-built, at the time of construction the strength of masonry most likely will be below that assumed while it is in service. So, from a practical point of view, it is impossible to prevent walls under construction from blowing down under some circumstances. Note that in most cases, the loads imposed during construction are also likely to be less than service loads. As a result, the Standard is intended to permit masonry construction to continue during low wind speed conditions, but requiring workers to evacuate designated areas of the job under high wind conditions. The Standard is available for purchase at www. The Internal Bracing Guide is available as a free download at www. She can be reached at dthroop imiweb.

Chapter 4 : Resources | MASONPRO

Practice for Bracing Masonry Walls During Construction (ref. 3) by the Council for Masonry Wall Bracing, there were no uniform guidelines for masonry wall stability.

Chapter 5 : STRUCTURE magazine | Bracing Masonry Walls under Construction Using Their Own Strengt

Get this from a library! Standard practice for bracing masonry walls during construction. [Council for Masonry Wall Bracing.; Mason Contractors Association of America.;].

Chapter 6 : Standard Practice for Bracing Masonry Walls Under Construction, MCAA Store

In this session the basics of bracing masonry walls during construction will be covered. Discussions will cover the basics of the OSHA regulations and using the standard practices required for bracing masonry walls.

Chapter 7 : BUILDERâ€™S RISK GUIDE TO LOSS PREVENTION: TEMPORARY MASONRY WALL BRA

the type of masonry construction, masonry wall heights, the time elapsed since construction, and wind speeds at the site. The industry term "internal bracing" is relatively new.

Chapter 8 : ASTM C - 18 Standard Practice for Construction of Dry-Stacked, Surface-Bonded Walls

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Chapter 9 : Construction Depth Design Standards

Internal bracing of masonry walls under construction is based on the cantilevered performance of the wall and utilizes predicted capacity to resist defined wind loads that may occur during construction and before the wall's final lateral support is in place.