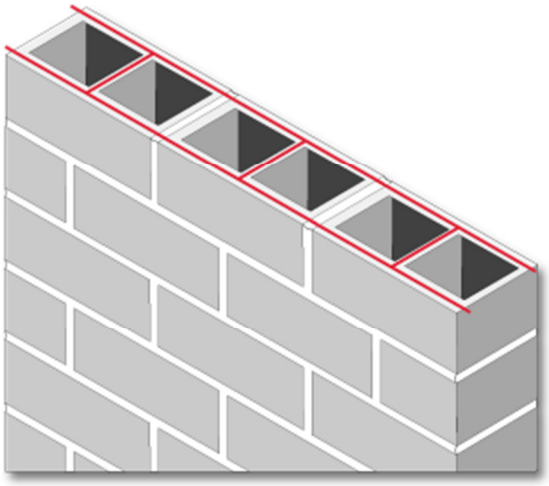
MCAA
MASON CONTRACTORS ASSOCIATION OF AMERICA

UPSTATE NEW YORK MCAA CHAPTER

Pre-Construction Meeting Topics

A Focused Discussion On Horizontal Joint Reinforcing In Concrete Masonry Walls

These are general guidelines, if plans or specifications show different requirements, please verify with the architect.



This document is focused on the role of Horizontal Joint Reinforcement (HJR) in controlling cracks in concrete masonry walls. This is not intended to be a design document, or a complete discussion of controlling movement in concrete masonry walls. The goal is to give masons a better understanding of the importance of HJR and general practices to follow installing it. When we refer to the "Code" in this document we are referring to "Building Code Requirements and Specification for Masonry Structures or TMS 402/602."

Horizontal Joint Reinforcement (HJR) is inexpensive, simple to install and critical for the performance of a concrete masonry wall. To appreciate the importance of HJR in the performance of concrete masonry walls it is helpful to understand that almost all masonry walls are constantly moving throughout the life of the structure. Clay brick can expand 1 inch per 100 linear feet. Concrete masonry can shrink 1 ¼ inches per 100 linear feet.

Movement in masonry walls can be influenced by the physical properties of the units, the color of the units, carbonation, the temperature and moisture content when the masonry was installed, temperature variances where the building is located and nonuniform exposure to sunlight and moisture. Yes, it is complicated! However, the masonry industry is a mature industry that has researched its systems for generations. The physics of both clay and concrete masonry are well understood and when the "Code" and industry best practices are followed, this movement has no negative affect on the performance of the wall.

It is the responsibility of the architect/engineer to specify concrete masonry movement details like HJR and control joints in the contract documents. It is the responsibility of the masons to follow what is shown on the plans and specs and industry best practices for installation. If plans, specs and "Code" installation requirements aren't followed and cracking results, the cost to correct the deficiency can be extremely expensive. Failing to install HJR where it is specified, can cause the wall to crack long after the installation is complete. If you believe there is an irregularity or confusion, ask your supervisor to request clarification from the architect/engineer.

Listed below are some of the points the mason should consider for concrete masonry walls:

The "Code" requires that designers develop details to accommodate thermal movement (shrinkage of cmu) and stress for concrete masonry walls. The industry created HJR for use in interior, exterior, below grade, above grade, structural and veneer walls. The only exception is when enough horizontal reinforcement is designed in bond beams to satisfy code requirements. This most often occurs in the high seismic regions of the country.

Typically the minimum HJR wire size is two 9 gauge wires spaced vertically (from one bed joint to another) a maximum of 16 inches on center. However, be aware that crack control is a design function and architects/engineers may vary the design to accommodate various concerns such as control joint placement and sometimes structural requirements. Larger diameter wire or more frequent spacing are common options they can use. Just because you haven't seen a particular wire diameter or spacing on your last several projects, it doesn't mean they are not critical to the project you are working on now. Follow plans and specs and if you have a question or concern always issue a timely request for information. At the end of this document we reference several National Concrete Masonry Association TEK notes and articles which further explain design options available to architects/engineers that you are likely to see on your jobs.

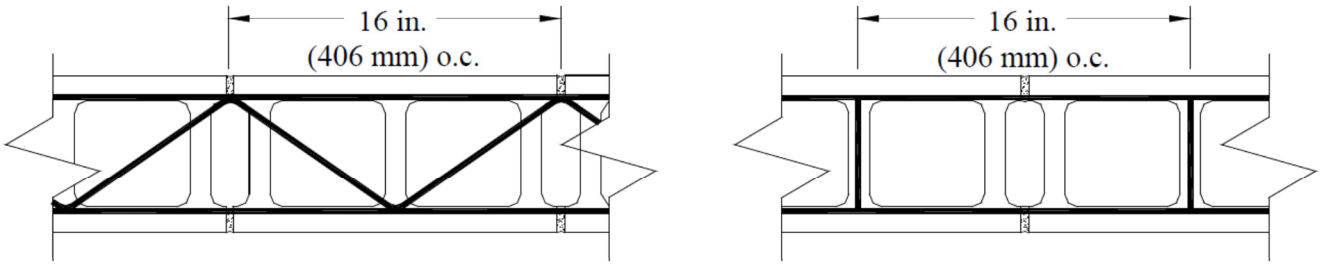
Be aware that the architect/engineer may increase HJR around openings in the wall. In a lightly reinforced load-bearing wall it is common to increase HJR above and below wall openings and in bed joints above floor level, below roof level and near the top of a wall. The "Code" requires the architect/engineer to provide this detail on the plans. If the information is missing, issue a request for information. The masonry industry has great tools to help architects/engineers work out these details.

Joint reinforcement should not extend through control joints unless specifically called for and detailed in the plans. One single course of HJR running through a control joint where it is not intended to, can cause a wall to crack.
Be aware that there are circumstances when the engineer will require HJR or a slip anchor to run through the control joint. However, if this is the engineer's plan, you should clearly see this detailed on the plans.

Typical slip anchor

Showing how the anchor slides

Truss HJR is not recommended in vertically reinforced walls. The diagonal cross wires will interfere with the placement of vertical reinforcing steel, grout and vibrators. It is recommended that cross wires in ladder-type reinforcement be set over cross webs of the cmu as shown below.



Truss-type **Ladder-type**

The width of the HJR should be approximately 2 inches less than the nominal width of the cmu. The typical length of a section of HJR is 10 foot.

Laying joint reinforcement directly on top of the cmu course, then spreading mortar over the wires and face shell or unit in one operation is an acceptable practice. Due to irregularities in the cmu wall and the wire, mortar surrounds the wire and bonds the components of the assemblage.

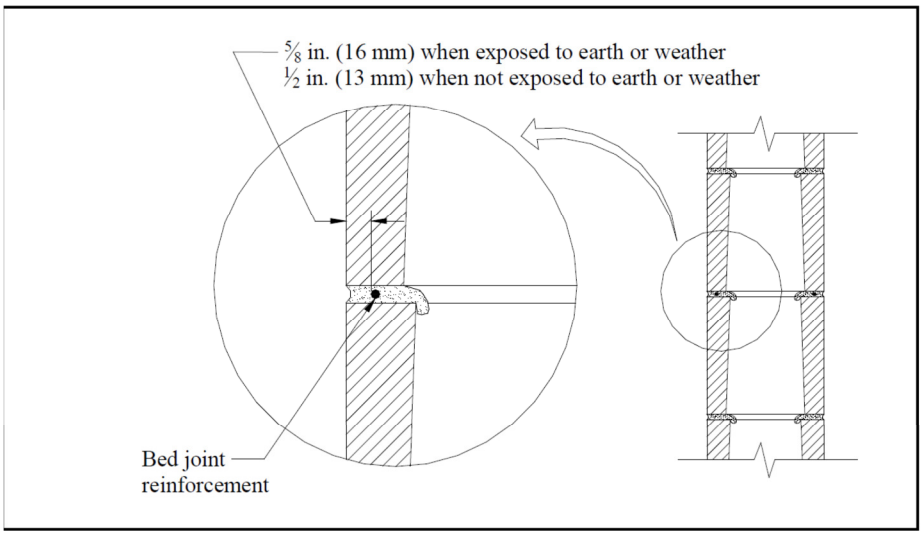
Joint reinforcement should not be placed between thin layers of bed-joint mortar, because thin layers of mortar tend to dry out and loose bond to the masonry unit or between the thin layers.

The Upstate New York Mason Contractors Association of America has “Code” based on-line mason training for masons that explains mortar joint tolerances. The link is listed below:

http://www.upstatenymcaa.com/mortar-for-masonry/

Placing joint reinforcement on top of freshly laid bed joint mortar is also not recommended, because this procedure results in voids between the bed joint and the overlying unit.

The “Code” requires nearly all exterior applications to use hot-dipped joint reinforcement, stainless steel or sometimes epoxy coated HJR. Interior walls exposed to a mean relative humidity above 75%, are also required to use a minimum of hot dip galvanized, stainless steel or epoxy coated HJR. Architects don’t expect a mason to be a weatherman and know the humidity levels. They do expect masons to understand that different cmu walls can require a different HJR coating and be familiar with what is specified for the walls you are working on.



Cover requirements for joint reinforcement, according to the “Code” are ½ in. to the inside (non-weather-exposed) face and at least 5/8 in. to the exterior face of a wall that is exposed to earth or weather. The “Code” increases the cover requirement in cmu veneer. Wire joint reinforcement in masonry veneer is required to have a minimum of 5/8 inch cover on both sides.

HJR installed without minimum cover requirements

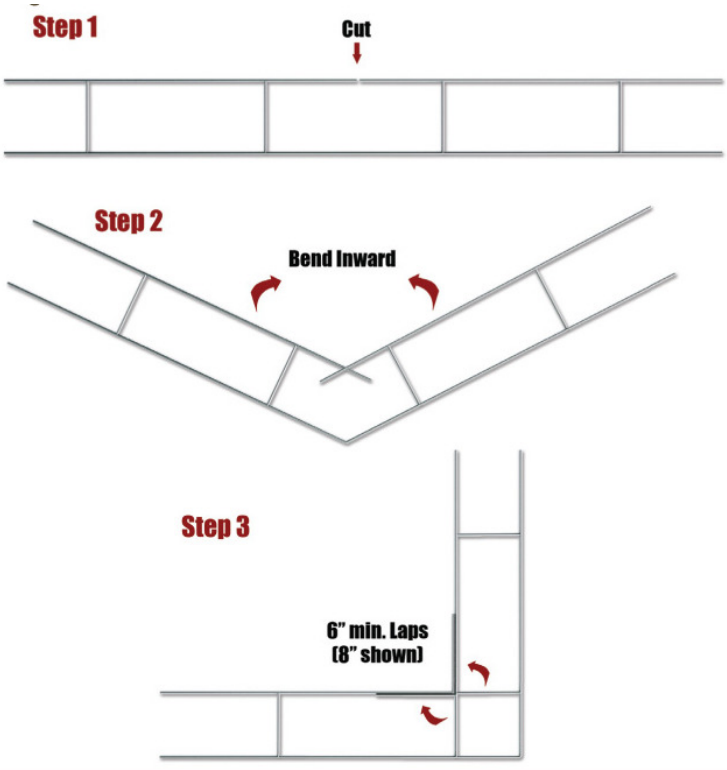
Corrosian of HJR without minimum cover.

Installing HJR with the cover required by “Code” is not hard, however the consequences of installing HJR too close to the mortar joint surface can be severe. The photo on the left shows HJR installed without minimum cover. The photo on the right is a different building where the HJR was installed too close to the surface approximately 20 years ago. Under the right circumstances, expansion of the HJR steel from corrosiun creates stresses in the mortar that can eventually cause cracking and spalling. In the photo on the right, the building owner attempted to stop spalling mortar by caulking the bed joint.

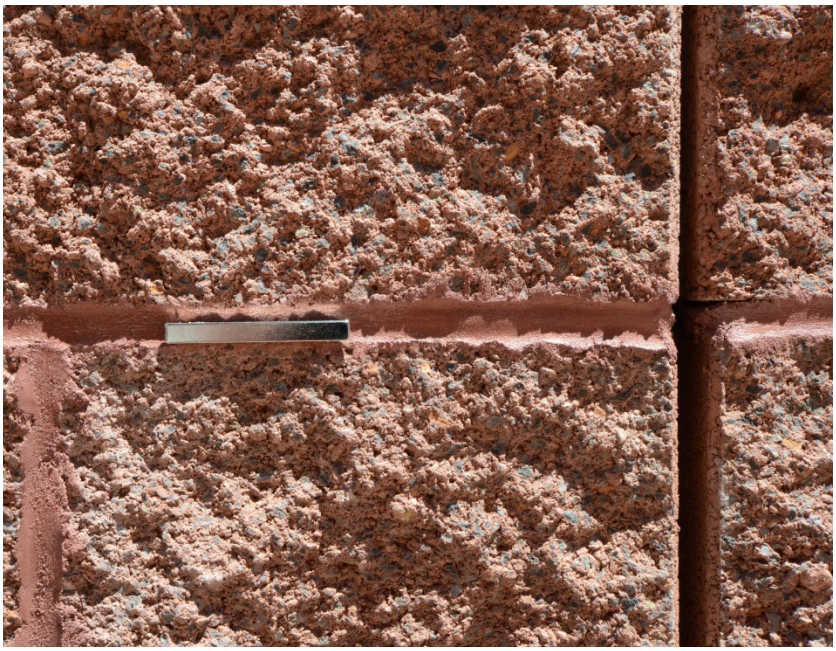
This photo shows splicing before full mortar coverage was applied.

The “Code” requires joint reinforcement segments be lapped a minimum of 6 inches for 9-gauge wire and 9 inches for 3/16” wire. Both sets of lapping wires must be embedded in mortar or grout. This length of lap is considered sufficient for joint reinforcement that is used to control shrinkage.

The requirement for lap splices provides continuity of the joint reinforcement. At wall intersections and corners, prefabricated tees and corners are available to provide continuity. The “Code “ allows for field fabricated configurations provided the corrosion protection requirements are met. Check specifications to confirm the requirements of the project you are on.



Masons can sometimes lose track of which courses they installed the HJR. This can happen when returning to a job after several days off, particularly when working with 4" high cmu with spacing 16 inches on center vertically or solid cmu veneer units where you can't look down into the cores for the HJR. Certain magnets can be a good tool to help find HJR in these situations. Simply hold the magnet against the bed joint. If that course contains HJR the magnet should cling to the joint. Slide the magnet along the bed joint horizontally to confirm the magnet is sensing a continuous length of HJR verus an anchor location. Websites like K&J Magnetics sell neodymium bar magnets. Model BY044 is shown in this photo. https://www.kjmagnetics.com/



This photo shows a model BY044 magnet clinging to a bed joint with HJR. Note that the HJR does not run through the control joint that is on the right. This wall is under construction; photo was taken before the backer rod and caulk were installed.

Be aware that certain types of stainless steel are not magnetic.

No discussion of crack control in concrete masonry walls is complete without a thorough review of control joints and other movement design and installation considerations. The reason horizontal joint reinforcing is the focus of this brief document is that sometimes the importance of HJR is overlooked or misunderstood. The fact that problems can surface years after the building is built has sometimes led to a failure to recognize the important role that HJR can play minimizing cracks and the resulting moisture penetration damage.

For further information on the greater topic of movement control in concrete masonry walls, please refer to the following technical resources:

Bonding with Masonry by David Biggs
This is a Q&A article on masonry movement in The Mason Contractors Association of America's Magazine "Masonry Design" Fall 2018, page 64.

The following National Concrete Masonry Association TEK Notes can be accessed through NCMA's resource center:
https://ncma.org/resources/tek-solutions-center/
Click on TEK Notes.

TEK 10-01A: Crack Control in Concrete Masonry Walls
TEK 10-02C: Control Joints for Concrete Masonry Walls-Empirical Method
TEK 10-03: Control Joints for Concrete Masonry Walls-Alternate Engineered Method
TEK 10-04: Crack Control for Concrete Brick and Other Concrete Masonry Veneers
TEK 12-02B: Joint Reinforcement for Concrete Masonry

The Upstate New York Mason Contractors Association of America has developed a series of education and training modules for masons based on Industry Best Practices and TMS 602, Specifications *for Masonry Structures*.

These free videos can be seen by following this link: http://www.upstatenymcaa.com/ and clicking into the "Education" section at the top of the page. Look for "Above Grade-Code Base Masonry Training."

"Mortar for Masonry"
"Flashing for Masonry" Part 1
"Flashing for Masonry" Part 2
"Flashing for Masonry" Part 3