Chapter 9 – Design Guides

9.17.4 MASONRY GUIDE

A. FIELD INVESTIGATIONS

1. Existing Masonry Field Investigations:
The Consultant/Designer shall perform field investigations and conduct exploratory assessments of unforeseen conditions to verify existing conditions. Probes and invasive testing shall be done as required and approved by the PM to determine the extent of project scope. Testing of mortar and masonry may be warranted to determine physical properties, application, and the availability of materials. The Consultant/Designer may engage a contractor during the Program or Design Phase to assist with building access, destructive and non-destructive testing and masonry restoration. Coordinate this investigation with the PM and Client.

B. TECHNICAL RESOURCES

1. Brick Masonry Design:
The Consultant/Designer's masonry design should follow the recommendations of the Brick Industry Association (BIA) www.gobrick.com contained in the publication, Technical Notes on Brick Construction.

2. Concrete Masonry Design:
The Consultant/Designer's concrete masonry design should follow the recommendations of the National Concrete Masonry Association (NCMA) www.ncma.org contained in the publication, TEK Manual for Concrete Masonry Design and Construction.

3. International Masonry Institute (IMI) www.imiweb.org provides technical assistance and resources for brick and concrete block design.

C. INTERDISCIPLINARY COORDINATION

1. The Structural Designer and Architect shall coordinate the structural steel frame column, beam and bracing sizing and locations with the adjacent exterior masonry wall to minimize penetrations into the masonry cavity. Plan and section details should indicate continuous rigid insulation and continuous air/moisture barrier construction.

2. Lintels are to be provided over openings and shall be designed to support loads above and account for the width of the opening. Coordinate opening placement with the structural designer as to not impact the structural design capacity of shear walls and loadbearing walls. When steel lintels are used they shall be hot dipped galvanized. Lintels and flashings shall be detailed to indicate weeps, Mortar Net and flashing end dams.

D. MOISTURE MANAGEMENT

1. Water migration through exterior masonry structures exposed to rain should be anticipated. Water can migrate through joints between the mortar and the masonry units due to bond separation, voids, and cracks. Water migration can also occur due to absorption through the masonry units and mortar. Exterior masonry cavity wall construction must address water penetration into the wall system.
2. Consultant/Designer shall consider control of moisture migration, vapor drive and air movement in the design of exterior masonry veneer walls. The air cavity behind the veneer allows water to flow down to the base flashing and out through the weeps.
3. Continuous air barriers are mandated in the Energy Conservation Construction Code of New York State.
4. Best Practice:
   A combination air and moisture (water-resistive) barrier should be used between the masonry veneer and the exterior face of the back-up wall. The air and moisture barrier material shall be continuous, durable and be able to withstand construction exposure and air pressure differentials which can be caused by wind, stack effect and mechanical systems to be effective. Spray-on products and application is preferred for concrete masonry back up walls. Show locations on the wall details including penetrations such as conduit, utility services, ducts, piping, windows and doors that must be sealed.
5. The Consultant/Designer shall determine the need for a vapor retarder by reviewing the Energy Conservation Construction Code of New York State and performing a dew point analysis. Vapor retarders shall be considered for use on projects with high internal moisture generating spaces such as gyms, pools, and food processing.
6. The Consultant/Designer should select a material that can serve multiple functions to control air, moisture and vapor when required. This selection and control is dependent on the physical properties of the material. Consult with product manufacturers for proper usage, placement and detailing.

E. CAVITY WALL AIR SPACE AND INSULATION

1. Cavities exceeding the code maximum of 4 ½ inches will require analysis / calculations to be performed for the tie anchors.
2. Cavity walls are designed not only to guide any moisture occurring in the cavity to move downward to the flashing and weep vents, but also to allow a certain flow of air throughout the cavity. Recommend providing a 2 inch minimum clear drainage cavity (not including the insulation) to be effective to allow for proper construction of the wall and to minimize mortar fins, droppings and bridging.
3. Clearly indicate insulation attachment method either mechanically or adhered to masonry backup. Friction fitting rigid insulation between horizontal reinforcement is not an acceptable solution.

F. FLASHINGS

1. Consultant/Designer shall show flashing details for installation for lapping / sealing, terminations and end dams, inside corners and outside corners (either field formed or prefabricated), wall to roof line, base flashing and copings. Isometric or 3D drawings shall be used to convey proper detailing.
2. Where the flashing is not continuous, such as over and under openings in the wall and on each side of vertical expansion joints, the ends of the flashing should be extended beyond the jamb lines on both sides and turned up into the head joint at least 1 in. at each end to form a dam.
3. Provide weep vents and Mortar Net at all wall flashings.

G. MOVEMENT JOINTS

1. Consider material movement and differential movements. Both brick and concrete masonry experience repeated thermal movements when exposed to warm and cold temperatures. Brick also expands under moisture variations. Proper joint design along with proper locations is necessary to accommodate these movements. Therefore, the Consultant/Designers shall locate horizontal and vertical expansion joints and control joints on drawing elevations and provide large scale details.
2. Expansion Joints:
   - **a.** Expansion joints are typically required for exterior masonry construction. Consultant/Designer drawing elevations shall locate joints at corners, offsets, and other changes in wall plane; changes in wall construction; and at regular spacing typically 20 to 30 feet on center maximum, depending on the units.
   - **b.** Guidelines for accommodating expansion of masonry can be found in the technical resources noted above.
   - **c.** Locate relief angles / shelf angles joints on elevations and provide details. Relieving angles shall be hot dipped galvanized and continuous and around corners including at columns. Isometric or 3D drawings shall be used to convey inside and outside corner angle detailing.
   - **d.** When lipped brick is detailed at shelf angles to reduce the horizontal soft joint, coordinate detail with structural designer for masonry bearing area on the shelf angle's horizontal leg. Specify special shape lipped brick and do not allow field cut brick.
3. Crack Control:
   - **a.** Interior concrete masonry walls are typically reinforced with joint reinforcement for shrinkage control. Depending on the size and spacing of the reinforcement, the spacing of control joints will vary. Control joints are required in all concrete masonry walls.
   - **b.** Guidelines for accommodating expansion of masonry can be found in the technical resources noted above.

H. QUALITY ASSURANCE / QUAILITY CONTROL

1. Pre-Installation Meeting:
   - **a.** Consultant/Designer should ensure that a pre-installation meeting is specified and that their attendance to this meeting and any mock-up reviews are

included during the construction phase. Best Practice: This meeting should not take place until all masonry submittals have been approved.

b. Consultant/Designer shall discuss grouting and reinforcing when specified on a project, especially when used for security walls. Grout slump shall be between 8"-11" (pourable). Low lift grouting (4-5 feet) shall be specified to allow better flow around obstacles and allow inspectors better opportunity to observe the cavity before and during installation of grout. Grouted walls require Special Inspections per Chapter 17 of the NYS Building Code. The Consultant/Designer's structural engineer shall fill out BDC 406 Summary of Special Inspections and BDC 406.1 Statement of Special Inspections for grouted walls, shear walls and seismic reinforcement.

c. A pre-developed *Masonry Pre-Construction Meeting Agenda* is available to use for this meeting. However, this agenda should be tailored to the specific project conditions.

2. Wall Mock-Up:

a. The Consultant/Designer shall provide sufficient detailing in the wall mock-up drawing and specifications so that the contractor will accurately construct building elements in the same construction sequence proposed for the building and as shown in the contract documents. The mock-up panel should contain all elements such as: precast sills, steel lintels, window unit, movement joints, ties and anchors, joint reinforcement, grouting, flashings including laps and end dams, Mortar Net, weep holes, sealants, cavity insulation, air and moisture retarders, brick and concrete masonry bond pattern, texture and color, and mortar of the correct color and strength. It is also prudent to include inside and outside corners.

b. The Consultant/Designer shall visit the project site to review the mock-up work. Resolve any problems inherent in the construction process and agree to on an example demonstrating the finished construction. The mock-up shall establish the level of quality and is the standard by which the buildings wall construction is judged.

c. The mock-up must be approved prior to start of masonry work on the building.

3. Inspections:

a. Inspections should be provided for security walls to ensure integrity.

b. Special Inspections when required by building code.

c. Regular inspections to verify conformance to the contract documents.

d. Periodic site observations by the Consultant/Designer.

e. The Consultant/Designer shall discuss participation in the various types of inspections noted above with the PM and EIC.

Revision History:

Rev	*Date*	*Description*	*Reviewed by:*	*Approved by:*
0	08/12/2013	New chapter	Feldman	Parnett
1	09/04/13	Minor revisions	Feldman	Parnett