Diane Travis
Technical Director
Rocky Mountain Masonry Institute
686 Mariposa Street
Denver, CO 80204
303-893-3838
dianet@rmmi.org

SINGLE WYTHE WALLS

In an ever-escalating effort to save money without sacrificing quality, some owners and architects are asking for buildings constructed with single wythe masonry. These structures can indeed be a very cost effective solution when the owner wants the permanence and low maintenance of a masonry building but has a very limited budget. Since a single line of oversized brick or block serves as the structural system, the outside finish and the inside finish, you gather economy by eliminating some systems and by simplifying others.

Everyone should be aware that single wythe walls do not have the redundancy of a traditional cavity wall. To obtain the weather-resisting quality of a cavity wall, the single wythe wall must be very carefully detailed and very carefully built. Pay attention to the following items:

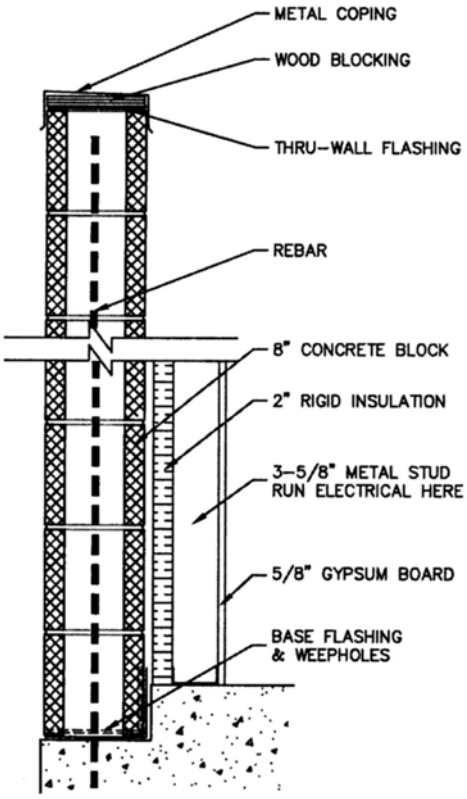
FLASHING

Water which penetrates the skin of the masonry will travel down the open cores of the brick or block. Since a single wythe wall is not as efficient in expelling water as a cavity wall would be, you need to work hard to keep the water OUT of the wall. Thru-wall flashing at the parapet cap and under window sills is your first line of defense. Flash/weep systems are also recommended above bond beams where the solid line of grout stops the downward flow of water.

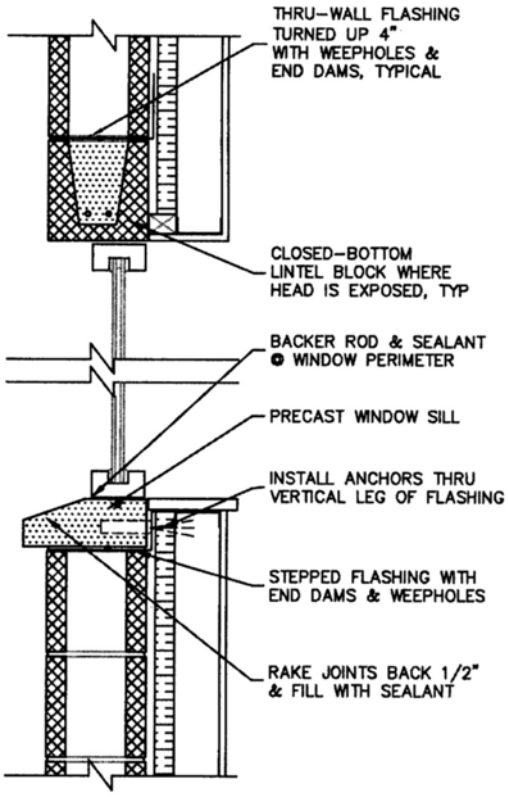
BASE CONDITION

If water does get into the wall (and a wise architect will assume that some water will get in), flashing and weepholes will direct this moisture back to the outside face of the building. Several companies have designed single wythe weep systems that work well. Cavity Vent by Masonry Technologies and Blok-Flash by Mortar Net are two of the most common weep systems for single wythe walls. Both are easy to install and both provide a weep hole at each ungrouted masonry core. These systems do not interfere with rebar placement and do not create a shear plane at the base of the wall. Go to their web sites to read more about these products. www.masonrytechnology.com www.mortarnet.com

It is also a good idea to have the first course of masonry start at least 1-1/2" below the level of the finished floor. If you lay the first course directly on the first floor slab, wind-driven water can seep under the base flashing and leak into the building. If there is a step in plane at this vulnerable point, you are much less likely to get water leaking into the building at the base.



CAP & BASE FLASHING
SINGLE WYTHE MASONRY



SILL & BOND BEAM FLASHING
SINGLE WYTHE MASONRY

STRUCTURAL CONCERNS

The structural engineer on the project usually designs structural connections where floor or roof planes tie to the load-bearing exterior walls. All connections must meet code for structural capacity and rigidity. Beams and joints of intersecting floors can either rest on a ledger beam or they can sit in pockets in the masonry wall. You need to design a bond beam under the beam locations to carry the increased point loads. Beam pockets are more difficult and more expensive to build than ledger beams or angles. They also require the mason to coordinate his work with the guy who is erecting the steel because the steel joists must be installed before the mason can build the rest of the wall above the beam pockets. If you use ledger angles, the mason can complete his work and the steel can be installed any time later. Check with the local building officials to see which system will be best for you.

Single wythe walls get some of their efficiency and cost savings from fully utilizing the exterior wall as a structural system. Structural engineers who are not comfortable with masonry detailing sometimes insert steel columns in the exterior wall. This approach not only doubles up the cost of the structural system, it weakens the exterior wall plane, making construction more difficult and encouraging cracks in the exterior wall at column locations. If you have a steel column notched into an exterior load-bearing wall, call for a control joint at each column location.

CONTROL JOINTS

Control joints are just as important in one-wythe walls as they are in traditional masonry construction. You must allow the plane of masonry to shrink or grow with changes in temperature or moisture. Control joints in concrete block are typically made with a neoprene water stop rod inserted into slots in sash block units. The mortar at the control joint is raked back 3/4" and sealant is applied over the recessed mortar.

Control joints in structural brick are usually made with a Z-shaped piece of reinforcing laid in the horizontal mortar joint. Because brick will expand as it ages, the brick control joint is left void (NO mortar) and filled with a backer rod and sealant. Both of these control joints allow the wall to shrink or expand (in plane movement) but they do not allow the wall to be dislodged by lateral loads (out of plane movement).

Review BIA Tech Note 18A (brick) and NCMA Tek Note 10-2 (CMU) for proper spacing of control joints.

INSULATION

For optimum *thermal* performance install rigid insulation on the outside face of the wall. E.I.F.S. systems buffer the variations in temperature before they reach the building. This detail, however, gives up the great low-maintenance, long-lived weather-shedding skin a masonry wall can provide.

Insulation installed on the inside face of the wall is usually installed in the space between studs and shares this zone with plumbing and electrical lines. Do not use batt insulation behind a one-wythe wall. If it gets wet, it is useless. Only rigid insulation can tolerate the possible (and probable) water infiltration. If you spray-apply a water repellent coating or dampproofing on the inside face of the masonry, the wall *might* be dry enough to allow you to install batt insulation. Test the wall to be sure it is dry before installing batts.

Loose-filled perlite, vermiculite or expanding foam can be poured into the open cores of concrete block and reinforced brick. Cell-filling insulation is often specified in one-wythe walls where both the interior and the exterior face of the masonry will be left exposed. This type of insulation can be compromised if protruding fins of mortar block the vertical cores of the masonry leaving air voids in the column of insulation. Thick masonry units (10" and 12" deep) have fewer problems with these mortar fins than thinner ones because the core holes are larger. You should also be aware that the efficiency of insulation poured in the cores of structural brick or block is limited by the many thermal bridges of the webs of the masonry units. Cold travels through these dense webs bypassing the insulation in the masonry cores.

Molded foam inserts of rigid polystyrene are manufactured specifically for use in the cores of masonry units. These inserts are usually stuffed into the cores of brick or block at the manufacturing plant, thus protecting the insulation from damage at the job site.

FULL HEAD JOINTS

A cavity wall handles water infiltration by draining the water down the cavity and wicking it out through the weepholes. A single wythe wall is not as efficient in handling wind-driven rain. Face shell bedding is typically specified for all hollow unit applications (both brick and block). To be effective the head joints need to be solidly filled for the full depth of the face shell on both sides of the wall. Face shells are typically 1" to 1-1/2" thick. Double buttered head joints are even more water resistant.

WATER REPELLENT COATINGS

While brick has an inherent water repellent skin, concrete block does not. ALL concrete block walls need a water repellent coating to resist wind driven rain. You can choose to specify an integral water repellent or a post-applied spray. The integral repellents must be added to the concrete block during the manufacturing process. A post-applied spray is put on the wall after the cleaning is complete. It is important to be sure that the wall is thoroughly dry before you apply the water repellent coating. Test both sides of the wall with a moisture meter before spraying the block. The wall should contain no more than 4.5% moisture. Silane and siloxane water repellent products penetrate about 1/4" into the face shell of the block. They last the longest.

If you choose to use an integral repellent, you need to add the repellent product to the mortar as well as the block. Integral repellents work much better with normal weight block than with lightweight block. You also need to be very careful about the cleaning processes you use on the wall. Overly-aggressive cleaning can wash the repellency from the face shell of the block and may void the warranty.

PROPER CLEANING PROCEDURE

The last step in building a masonry wall is to clean the mortar smears and construction dirt off the wall. Aggressive cleaning can damage any masonry work but you need to be especially careful with single wythe walls. Sandblasting to clean the wall can expand an imperceptible crack and allow water to funnel into the wall. It can also make the block more porous. Aggressive pressure washing with harsh chemicals can wash away much of the repellency of integral water repellent block.

We advise that you instruct your mason to keep the wall as clean as possible while he is building the wall. He should also clean the wall as soon as possible after the mortar is fully cured (7-10 days). Although pressure washing is an accepted method of cleaning new construction, you should limit the pressure to 600 p.s.i. or less and you should always rinse the chemicals off the wall when you are finished. Insist that the masonry contractor (not the general contractor) hire the cleaning contractor as his sub. The mason contractor will then be responsible for the work done by the cleaning crew and will carefully supervise their work.