

**Movement is Inevitable... we MUST accommodate for it**

A 10'-0" long CMU wall wants to move 1/8" but if restrained, will have a compressive load of over 200,000 #/sf



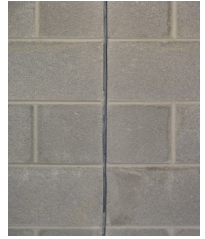
**Expansion joints** are placed in clay masonry.  
**Control joints** are placed in CMU.  
THEY DO NOT NEED TO ALIGN.



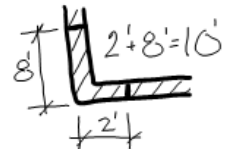
**Movement joints MUST be cleaned out prior to any installation of backer rod & sealant. Always Review**

Concrete masonry units (CMU) and cast stone change size with temperature and moisture. Just like concrete, these materials will shrink once installed and dry, and expand if saturated. The stress which is created by the movements if restrained are considerable and is only compounded by today's material technology and design. We need to honor these natural movements and make sure we install proper control joints for cracking and install backer rod and sealant in order to keep moisture from entering our wall system and cause damage of our buildings.

**Corey Zussman, AIA, NCARB - Director of Quality Management**



- ▶ There are three types of movement joints: **Expansion** (Clay Masonry), **Control** (Concrete Products), & **Isolation**.
- ▶ According to the "Masonry Standards Joint Committee" (MSJC), which develops masonry design & construction standards for the building codes states that "Designers shall locate all control joints". Always RFI Architect if not located.
- ▶ CMU & Cast Stone experiences shrinkage as a result of moisture content loss and carbonization.
- ▶ Carbonization is an irreversible reaction between cementitious materials & carbon dioxide which will reduce the overall strength & will increase shrinkage. The result is about 1/4" per 100' of wall of shrinkage over a several year period in a normal environment (not a parking garage) When constantly around cars, the several years turns into a year or less.
- ▶ CMU & Cast Stone will expand slightly due to increased moisture content. *This is why we must cover the material prior to installation in order to maintain size of all units going into the wall.*
- ▶ CMU & Cast Stone walls constructed with wet units will have more shrinkage cracks than dry units.
- ▶ Increases in cement content in the mortar as well as smaller aggregate size will negatively affect the shrinkage... Typical shrinkage when the CMU unit is dry will be 1/4" to 1/2" per 100' of wall.
- ▶ Typical temperature shrinkage will be about 3/8" per 100'-0" of wall when the temperature outside is 0°F and the CMU was laid in 70°F weather.
- ▶ When vertical movement is not properly accommodated in the design, the following happens:
  - LONG WALLS .....Sealant is forced out of the joint or diagonal cracks happen between openings.
  - CORNERS .....Cracking occurs at the 1st head joint in plane of a wall.
  - OFFSETS/SETBACKS .....Vertical cracking at junctions.
  - STRUCTURAL FRAME .....Creep of frame or deflection of frame—horizontal cracking.
- ▶ Unlike clay masonry, moisture & temperature shrinkage in the CMU & cast stone units is reversible and will even expand if saturated.
- ▶ Shrinkage cracks in CMU walls are typically aesthetic rather than structural. Control joints are typically required in walls where cracking may detract from the appearance OR when water penetration is a concern. In interior walls, CJ are not required per code.
- ▶ Using a lower compressive strength mortar helps ensure when cracks do occur, they occur at the mortar joint.
- ▶ Frequency of movement joints should be **25'-0" wall w/o openings, 20'-0" w/ openings**.
- ▶ Locate Vertical Movement Joints:
  - Maximum panel length to height ratio should be 1 1/2.
  - Within 2'-0" to 10'-0" of a corner...with a total of 10'-0" between the two joints around a corner.
  - Offsets, setbacks, and wall intersections
  - Changes in wall heights and CMU thicknesses
  - On one side of an opening if less than 6'-0" long, on both sides if greater than 6'-0" wide.
- ▶ Actual size or frequency of control joints may be 2x or 4x as originally calculated based on sealant.
- ▶ Equation for spacing between joints using sealant movement capability:



$$S'' = W \times E / 0.0008$$

$S''$  = spacing between joints;  
 $W$  = width of expansion joint;       $E$  = percentage of sealant movement capacity

**EXAMPLE:** (NP-1 has 35% & NP-2 & Dow 795 has 50% movement capability): NP-1:  $(3/8" \times 35) / 0.0008 = 164" = 13'-8"$  Between joints      NP-2/Dow 795:  $(3/8" \times 50) / 0.0008 = 234.3" = 19'-6"$  Between joints

- ▶ Horizontal reinforcement should stop at either side of the control joint. (This does not pertain to a bond beam).
- ▶ CMU typically has a hard rubber shear key in the CJ in order to transfer stresses to each panel. CJ must be kept clean.
- ▶ Review specifications for special consideration when running rebar through at the CJ. Always discuss with architect prior to installation.
- ▶ Locate an Isolation joint at different materials, such as CMU, Cast Stone, & contrasting color bands, etc. The Isolation joint should consist of a racked back joint with backer rod & sealant and or a slip sheet (flashing).

*The following information was compiled from various sources, such as NCMATEK 10-1A, 10-2B, 10-3, & 10-4, and other industry experts.*

