

TEK NOTES

NCMA TEK NOTE 10-2B

The following information was taken in part from NCMA TEK note 10-2B. For more complete information please see the entire NCMA TEK note 10-2B at www.prairie-stone.com, NCMA TEK note link.

Empirical Method for Control Joints in Concrete Masonry Walls

Concrete masonry is a popular construction material because its inherent attributes satisfy the diverse needs of both exterior and interior walls. While these attributes are the primary basis for concrete masonry's popularity, performance should not be taken for granted. Like all construction systems, design decisions significantly influence field performance of the concrete masonry wall system. Proper application of crack control measures, including control joints when required, can help ensure satisfactory performance of the concrete masonry.

Control joints are one method used to relieve horizontal tensile stresses due to shrinkage of the concrete masonry units, mortar, and when used, grout. They are essentially vertical separations built into the wall at locations where stress concentrations may occur. These joints reduce restraint and permit longitudinal movement.

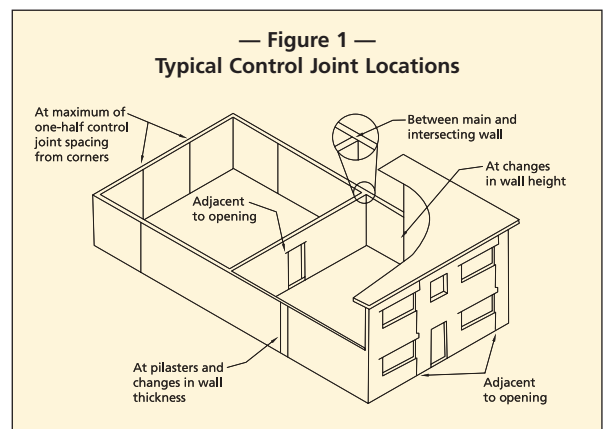
Control joints are typically only required in exposed concrete masonry walls, where shrinkage cracking may detract from the appearance of the wall. Shrinkage cracks in concrete masonry are an aesthetic, rather than a structural, concern. In addition, walls with adequate horizontal reinforcement may not require control joints, as the reinforcement effectively reduces the width of shrinkage cracks. Foundation walls traditionally do not include control joints due to concerns with waterproofing the joint to withstand hydrostatic pressure. Additionally, since foundation walls are subjected to relatively constant temperature and moisture conditions, shrinkage cracking in below grade walls tends to be less significant than in above grade walls.

This TEK focuses on cracking resulting from internal volume change of the concrete masonry. Potential cracking resulting from externally applied design loads due to wind, soil pressure, seismic forces or differential settlement of foundations is controlled by limiting the design stress in allowable stress design or by providing adequate strength when strength design is used. These design considerations are not covered here. Where external loads are an issue in combination with internal volume change, the design should consider the combined effects of these influences on cracking.

Control Joint Placement

When required, control joints should be located where volume changes in the masonry due to drying shrinkage, carbonation or temperature changes are likely to create tension in the masonry that will exceed its capacity. In practice, this can be difficult to determine, but several methods are presented in the following sections to provide guidance in locating control joints.

In addition, care should be taken to provide joints at locations of stress concentrations, such as (see Figure 1):



1. at changes in wall height,
2. at changes in wall thickness, such as at pipe and duct chases and pilasters,
3. at (above) movement joints in foundations and floors,
4. at (below) movement joints in roofs and floors that bear on a wall,
5. near one or both sides of door and window openings (generally, a control joint is placed at one side of an opening less than 6 ft (1.83 m) wide and at both jambs of openings over 6 ft (1.83 m) wide. Control joints can be away from the opening if adequate tensile reinforcement is placed above, below, and beside wall openings.),
6. adjacent to corners of walls or intersections within a distance equal to half the control joint spacing.

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Empirical Crack Control Criteria

For walls without openings or other points of stress concentration, control joints are used to effectively divide a wall into a series of isolated panels. Table 1 lists recommended maximum spacing of these control joints based on empirical criteria. This criteria has been developed based on successful, historical performance over many years in various geographical conditions. The empirical method is the most commonly used method and is applicable to most building types. An engineered method is presented in TEK 10-3 Control Joints for Concrete Masonry Walls – Alternative Engineered Method (ref. 1). It is generally used only when unusual conditions are encountered, such as dark colored units in climates with large temperature changes.

— Table 1 —
Recommended Control Joint Spacing for
Above Grade Exposed Concrete Masonry Walls

Distance between joints should not exceed the lesser of:

Length to height ratio	or ft (m)
$1\frac{1}{2}$	25 (7.62)

Notes:

1. Table values are based on the use of horizontal reinforcement having an equivalent area of not less than 0.025 in./ft (52.9 mm/m) of height to keep unplanned cracks closed.
2. Criteria applies to all concrete masonry units.
3. This criteria is based on experience over a wide geographical area. Control joint spacing should be adjusted up or down where local experience justifies but no farther than 25 ft (7.62 m).

The provisions in this TEK assume that units used in the construction comply with the minimum requirements of ASTM C 90 Standard Specification for Loadbearing Concrete Masonry Units (ref. 2) and that a minimum amount of horizontal reinforcement is provided as indicated in Footnote 1 of Table 1. It is intended to provide the most straightforward guidelines for those cases where detailed properties of the concrete masonry are not known at the time of design. As indicated in Footnote 3 of Table 1, local experience may justify an adjustment to the control joint spacings presented in the table.

To illustrate these criteria, consider a 20 ft (6.10 m) tall warehouse with walls 100 ft (30.48 m) long. Table 1 indicates control joints spaced every 25 ft (7.62 m). In this example, the maximum spacing of 25 ft (7.62 m) governs over the maximum length to height ratio of 1½ times 20 ft (6.10 m) or 30 ft (9.14 m). For walls containing masonry parapets, consider the parapet as part of the masonry wall below if it is connected by masonry materials such as a bond beam unit when determining the length to height ratio.

The control joint spacings of Table 1 have been developed based on the use of horizontal reinforcement to keep unplanned cracks closed as indicated in Footnote 3. The minimum area of reinforcement given, 0.025 in.²/ft (52.9 mm²/m) of height, translates to horizontal joint reinforcement spacing.

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