THE BRICK INDUSTRY ASSOCIATION

Brick Brief

August 2025

CORBELS

INTRODUCTION

Corbelling is the method used to incorporate projections and recesses into brickwork. It is defined as projecting a single course or successive courses of masonry out from the primary face/plane of the wall. When the same method is used to recess or step back a single course or successive courses from the face of the wall, it is sometimes referred to as "racking." The brickwork feature created by this method is referred to as a corbel, which will be used to describe both projected and recessed brickwork. This *Brick Brief* discusses the materials and methods used for the design and construction of prescriptive and engineered corbels.

BRICK

Specifications

Solid units (without cores or frogs) are generally recommended for projected and recessed brickwork. Units complying with ASTM C216, *Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)*, are typically used. Brick meeting the requirements for paving applications (ASTM C902, *Standard Specification for Pedestrian and Light Traffic Paving Brick*) are often a suitable option because they are manufactured to withstand more severe exposure conditions. Alternatively, brick units complying with ASTM C652, *Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)*, may be used when cores and cells are filled solid with grout or mortar.

Note that units complying with ASTM C216 are permitted to contain up to 25% void area created by cores or frogs. These must be at least ¾ in. (19 mm) away from the edge of the brick unit. Hollow units complying with ASTM C652 are permitted to have cores or cells located less than ¾ in. (19 mm) from the edge of the brick unit. The minimum edge distance depends on the style of hollow brick.

Exposed Surfaces

Core holes and cells of projected or recessed brick units should not be left open to exposure from the weather. Core holes and cells of brick units should be placed so the core holes and cells are not visible. It is recommended to have a minimum of ¼ in. (6.4 mm) overlap or cover between the edge of an unfilled core and the outside face of the unit above or below it. If appearance is not a concern, the cores and cells may be filled with grout or mortar. In courses where the cores might be exposed, it is recommended to use units without cores, cells or frogs. Such units are considered special shapes and must be clearly identified on the project drawings. When units without cores, cells or frogs are used, specify that all exposed surfaces of the shape match the appearance of the finished face.

Coated Units. When brick units with a coating are corbeled, the finish of the exposed bed surface of the unit should be considered. If it is desired to apply the coating to the exposed bed surface, the brick manufacturer should be consulted to determine if this is possible.

Glazed Units. Exposure of any unglazed surface of a glazed brick is not recommended. As a result, when a glazed brick unit is used in a corbel, all exposed surfaces should be glazed. Units with glazing on additional surfaces must be clearly identified on the project drawings. Consult the brick manufacturer when glazed units will be used to construct projected or recessed brickwork. Because the glazed surface impedes bond, it is recommended to avoid applying glaze to portions of surfaces that will receive mortar. However, if overspray of the glaze occurs, the surface can be scarified to improve mortar bond.

Continuously Sloped Surfaces. Creating projected or recessed brickwork results in horizontal stepped surfaces. In cases where a continuous sloped surface is desired, it is preferred to use special shaped units with a sloped face or faces. This condition differs from a sloped wall in that the bedding surfaces remain horizontal. Brickwork laid in sloped walls have angled bedding surfaces with the backing wall perpendicular to the bedding surface (Figure 1). Sloped walls are outside the scope of this document and must be addressed through

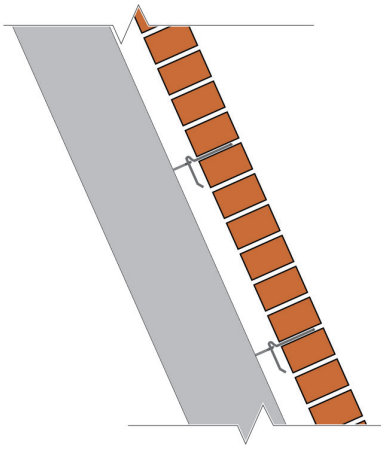
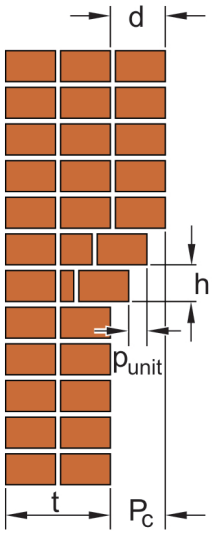


Figure 1: Sloped Wall

Figure 2: Chimney shoulder



Limitations on Corbelling

$P_c = \frac{d}{2}$

p_{unit} = smaller of $\frac{h}{2}$ or $\frac{d}{3}$

where:

P_c = Maximum allowable total horizontal projection of the corbel

p_{unit} = Maximum allowable projection of a single course

t = Nominal wall thickness

h = Nominal unit height (specified height plus the thickness of one mortar joint)

d = Nominal unit thickness (specified thickness plus the thickness of one mortar joint)

Figure 3: Corbelling in Solid Walls

the engineered design methods in TMS 402 Building Code Requirements for Masonry Structures.

Sloped surfaces such as chimney shoulders (Figure 2) can be constructed by placing units laid in a setting bed over a stepped or cut face. Units used for this application should be solid units without cores, cells or frogs, or should be pavers.

CODE REQUIREMENTS

TMS 402 discusses corbels in the Design Requirements section of the standard. These provisions include requirements for corbels that can be designed prescriptively and those that must be engineered.

Prescriptively Designed Corbels

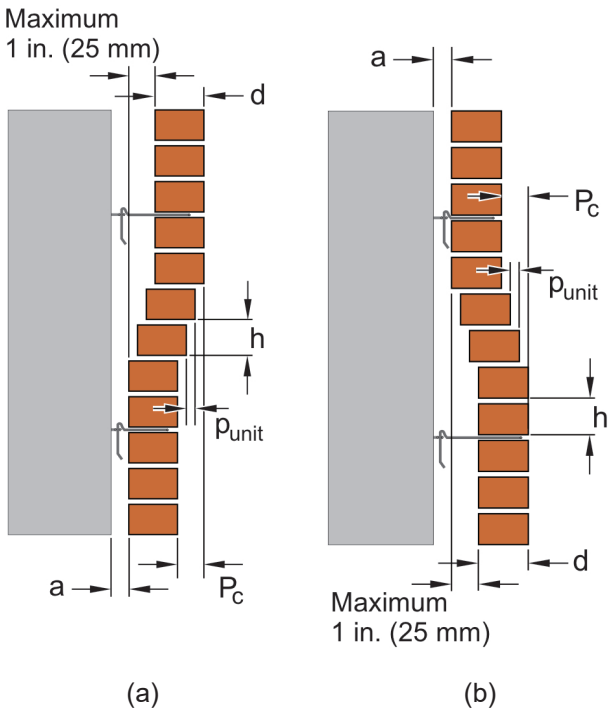
Corbels must meet both of the following conditions in TMS 402 to be prescriptively designed:

- The corbel is non-loadbearing.
- The dimensions of the corbel conform to the projection limits.

If the corbel does not or cannot meet these requirements, then it must be engineered.

Figure 3 depicts corbelling in multi-wythe composite (solid masonry) walls, and Figure 4a and Figure 4b depict corbelling in walls with an air space, which include non-composite cavity walls and anchored brick veneer. The prescriptive provisions in TMS 402 include limits on the projection of units in each course, as well as the overall projection of the entire corbel, as follows:

- The maximum projection of a single unit/course must not exceed the smaller of:
  - One-half the nominal height of the unit
  - One-third the nominal thickness of the unit or wythe



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where:

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d = Nominal unit thickness (specified thickness plus the thickness of one mortar joint)

a = Air space thickness

Figure 4: Corbelling in Walls with Air Space

- The maximum projection of the entire corbel beyond the face of the wall must not exceed either:
  - One-half the overall wall thickness for multi-wythe composite solid masonry
  - One-half the nominal unit thickness for walls with an air space behind the exterior wythe
- The back surface of the corbel must remain within 1 in. of plane.

These limits are intended to restrict the eccentricity introduced into the wall or the exterior wythe by the weight of the projected brickwork. The eccentricity is based on the horizontal distance from the face of the supporting element for the brickwork, not the cavity width. As a result, sloping the backing (Figure 5) to maintain a consistent cavity width does not permit a corbel to comply with the prescriptive requirements while exceeding the maximum horizontal dimension limit.

Where brick overhangs the face of its supporting element (such as with lipped brick on shelf angles in a veneer) the horizontal projection of the corbel includes the dimension of the overhang from the supporting element, which reduces the amount of corbelling that can be included above this course. In cases where there are multiple corbels incorporated within brickwork on the same support, the face of the corbel projecting the farthest from the face of the supporting element establishes the overall horizontal dimension of the corbel (Figure 6).

Recessed Brickwork. In the case of multi-wythe composite walls, there is no limitation on the distance each course may be recessed because the resulting configuration is consistently stable. However, for walls with an air space, the prescriptive limits noted above for projected brickwork also apply to recessed brickwork, as shown in Figure 4b.

Reduced Projection for Cavity Walls and Veneer. There is a significant difference in permitted overall corbel projection between a multi-wythe composite wall and a non-composite cavity or veneer wall. In a multi-wythe composite wall, the brick can be laid in various configurations, with sufficient interlock to counterbalance the projected mass. However, in veneer, particularly when the same width unit is used, little projection is possible before there is not enough mass to counterbalance or resist the forces caused by the projected mass. This causes an overturning moment that acts to pull the brickwork away from the backing. The same principle applies for recessed brickwork, except that the direction of moment is toward the backing. Per the prescriptive code, veneer ties are sized for lateral loads only. As a result, they are not permitted to carry the additional tension or compression load created by an overturning moment. When it is desired to exceed the prescriptive horizontal projection limit, the corbel must be engineered.

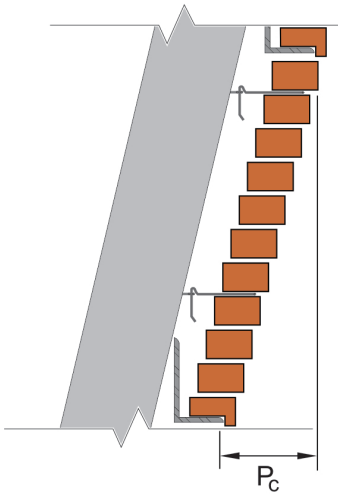

Figure 5: Sloped backing

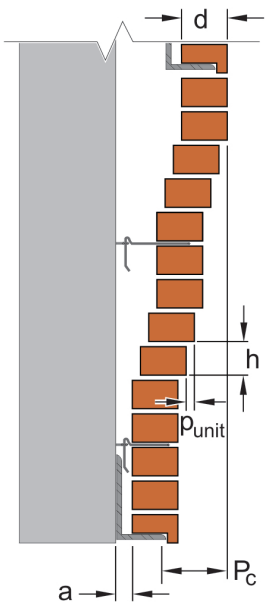

Figure 6: Corbelling in Walls with Air Space

Limitations on Corbelling

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where:

P_c = Maximum allowable total horizontal projection of the corbel

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Corbels Exceeding Prescriptive Code Limits. Corbels that exceed prescriptive code requirements are permitted when they are rationally designed in accordance with one of the engineered design methods in TMS 402.

Engineered Corbels

There are two types of engineered corbels:

- loadbearing corbels
- non-loadbearing corbels that do not conform to the prescriptive code requirements

Loadbearing Corbels. These corbels are structural masonry elements and must be designed in accordance with one of the engineered design methods in TMS 402. Consequently, the design of these elements is outside the scope of this document.

Non-Loadbearing Corbels Beyond Prescriptive. The most common example of non-loadbearing corbels falling outside the prescriptive code requirements is when a corbel in an anchored brick veneer has an overall horizontal projection that exceeds one-half the unit thickness. Depending on the extent of the horizontal projection, the solution may consist of using standard veneer ties at closer spacing or using veneer ties with heavier gauge components to resist the overturning forces. In both cases, a structural engineer would need to verify that the design resists the overturning forces.

When a corbel extends over many consecutive courses, such as in a spandrel configuration, it can exceed the maximum projection allowed for the corbel and the maximum prescriptive dimension for the cavity in a veneer. For both cases, a structural engineer would need to design custom-engineered veneer ties. Sloping the backing forward is a common solution to maintain a consistent cavity dimension behind the brick and to allow the use of standard, non-custom veneer ties (Figure 6). A structural engineer would need to verify that the standard, non-custom veneer ties are able to resist the overturning forces.

For veneer, only the sections of brickwork exceeding the prescriptive limits must be engineered, not the entire veneer. For example, if a large corbel is present at the top of a wall and the rest of the brickwork is traditional flush veneer, only the corbel would be engineered, and the remaining brickwork on the wall can be designed prescriptively.

SUMMARY

Corbels consisting of projected and recessed brick units are common features used to add interest and aesthetic appeal to brickwork, both historic and modern. TMS 402 provides guidance for incorporating these features into contemporary prescriptive veneer, non-composite cavity walls and multi-wythe composite masonry. For projects requiring projected or recessed brickwork beyond the prescriptive limits, TMS 402 permits engineered solutions.