

weight actually carried by the lintel. "Arching action" of the masonry will carry other loads outside the triangle, provided the height of the wall above the apex is sufficient to resist arching thrusts.

In addition to the dead load of wall contained within the triangular area, the lintel will also carry any uniform floor loads occurring above the opening and below the apex of the triangle. In *Fig. 11-5*, the distance D is greater than $L/2$, so the floor load may be ignored. If arching action does occur as described above, loads outside the triangle may be neglected.

Consideration must also be given to concentrated loads from beams, girders, or trusses which frame into the wall above the opening. These loads are distributed over a length of wall equal to the base of a trapezoid whose summit is at the point of load application and whose sides make an angle of 60° with the horizontal. In *Fig. 11-5*, the portion of concentrated load carried by the lintel is distributed over the length EC and is considered as a uniform load partially distributed. The sum of all loads is used to calculate the size of lintel required to span the opening.

Steel, precast concrete, reinforced concrete masonry units, and reinforced brick lintels are all commonly used to span openings in masonry construction. The table in *Fig. 11-6* lists allowable spans for steel, concrete, and masonry lintels supporting masonry veneer. For single-wythe CMU walls and for loadbearing masonry, engineering analysis should be used to determine lintel or beam sizing and reinforcement.

11.1.2 Steel Lintels

Structural steel shapes are commonly used to span masonry openings. Steel angles are the simplest shapes and are suitable for openings of moderate width where superimposed loads are not excessive (*see Fig. 11-7*). For wider openings such as garage doors, thicker walls, or heavy loads, multiple angles or steel beams with plates or angles may be required (*see Fig. 11-8*). The horizontal leg of a steel angle should support at least two-thirds of the thickness of the masonry.

Using steel lintels to span openings in masonry walls requires careful attention to flashing details, and to provisions for differential movement of the

Allowable Spans for Steel, Concrete and Masonry Lintels Supporting Masonry Veneer

Size of Steel Angle Lintel [§] , Vertical X Horizontal X Thickness (in.)	Number of 1/2" or Equivalent Reinforcing Bars in Masonry or Concrete Lintels [†]	Less Than One Story of Masonry Above Lintel	Lintel Supporting One Story of Masonry Above Opening	Lintel Supporting Two Stories of Masonry Above Opening
3 x 3 x 1/4	1	6'-0"	4'-6"	3'-0"
4 x 3 x 1/4	1	8'-0"	6'-0"	4'-6"
6 x 3-1/2 x 5/16	2	14'-0"	8'-0"	6'-0"
5 x 3-1/2 x 5/16	2	10'-0"	9'-6"	7'-0"
two 6 x 3-1/2 x 5/16	4	20'-0"	12'-0"	9'-6"

[§] Steel lintels indicated are adequate typical examples. Other steel lintels meeting structural design requirements may be used.

[†] Depth of reinforced lintels shall not be less than 8 inches, and all cells or cores of hollow masonry lintels shall be grouted solid. Reinforcing bars shall extend not less than 8 inches into the support.

Figure 11-6 Allowable spans for lintels in masonry veneer. (*From International Residential Code for One and Two Family Dwellings, 2003.*)

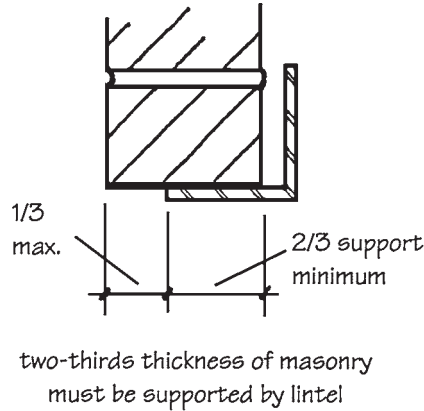


Figure 11-7 Steel lintel.

steel and masonry. Code requirements for fireproofing of steel members should also be thoroughly investigated. If fireproofing is required, it may be simpler to design the lintel as a reinforced masonry section. Steel lintels should be galvanized to prevent corrosion when they will be exposed to the weather.

11.1.3 Concrete and Concrete Masonry Lintels

Openings in concrete masonry walls are more commonly spanned with U-shaped lintel blocks grouted and reinforced with deformed steel bars. Reinforced concrete masonry lintels not only cost less than structural steel lintels, they eliminate the danger of steel corrosion and subsequent masonry cracking, as well as the painting and maintenance of exposed steel.

In some instances, cast-in-place or precast concrete sections can also be used. *Cast-in-place lintels* are subject to drying shrinkage and have surface textures that are not always compatible with the adjoining masonry. *Precast concrete lintels* and *cast stone lintels* are better in some respects because they are delivered to the job site ready for use, do not require temporary shoring, and can carry superimposed loads as soon as they are in place. These sections can be produced with surface textures closely matching that of the masonry, and can be scored vertically to simulate mortar joints. Precast lintels may be one-piece, or may be split into two thinner sections. Split lintels are relatively lightweight and easily handled. Split lintels, however, are not recommended to support combined wall and floor loads, because of the difficulty involved in designing the heavily loaded inner section to match the deflection of the outer section, which may carry only wall loads. Differential deflection could cause critical stress concentrations in the wall. Mortar for bedding precast lintels should be the same quality as that used in laying the wall, and at least equal to ASTM C270, Type N.

Reinforced concrete masonry lintels are constructed with special-shaped lintel units, bond beam units, or standard units with depressed, cut-out, or grooved webs to accommodate the steel bars (see Fig. 11-9). Individual units are laid end to end to form a channel in which continuous reinforcement and grout are placed. Among the major advantages of CMU lintels over steel are low maintenance and the elimination of differential movement between dissimilar materials. Concrete masonry lintels are often designed as part of a continuous bond beam course, which helps to further distribute shrinkage and temperature stresses in the masonry above openings. This type of installation is more satisfactory in areas subject to seismic activity.