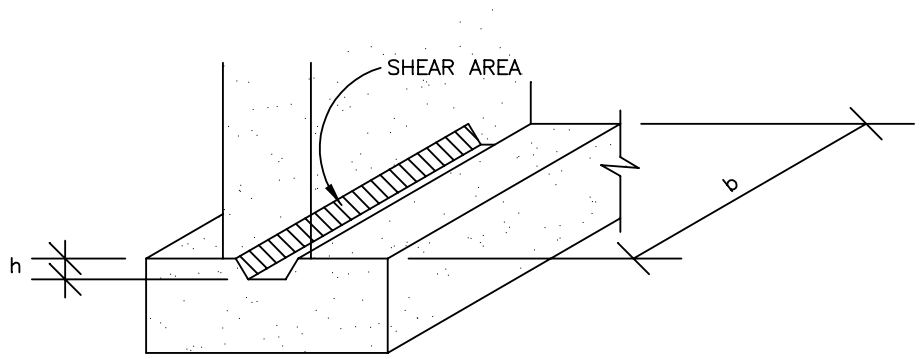
## *FIGURE 7.6 Key in Concrete Footings*




### *Dowels Used to Provide Adequate Shear Transfer*

Shear forces at the base of exterior foundation walls may require a dowel to transfer the forces from the wall to the footing. The equations below described by ACI-318 as the Shear-Friction Method are used to develop shear resistance with vertical reinforcement (dowels) across the wall-footing interface.

[ACI-318•11.7]

Masonry Walls

$$l_{be} \geq 12 d_b$$

$$B_v = \text{minimum of} \begin{Bmatrix} 350 \sqrt[4]{f'_m A_v} \\ 0.12 A_v f_y \end{Bmatrix}$$

Concrete Walls

$$V_u \leq \phi V_n$$

$$V_n = A_{vf} f_y \mu \leq \begin{Bmatrix} 0.2 f'_c A_c \\ 800 A_c \end{Bmatrix}$$

$$A_{vf} = \frac{V_u}{\phi f_y \mu}$$

$$\phi = 0.85$$

If dowels are used to transfer shear forces from the base of the wall to the footing, use the equations below to determine the minimum development length required (refer to Figure 7.7 for typical dowel placement). If development length exceeds the footing thickness, the dowel must be in the form of a hook, which is rarely required in residential construction.

[ACI-318•12.2, 12.5] Concrete Walls

Standard Hooks

$$l_{hb} = \frac{1200 d_b}{\sqrt{f'_c}} \quad \text{where } f_y = 60{,}000 \text{ psi}$$

$$\xi = \frac{f_y}{60{,}000}$$

$$\omega = \frac{A_{s,required}}{A_{s,provided}}$$

Deformed Bars

$$l_{db} = \left( \frac{3 f_y}{40\sqrt{f'_c}} \right) \left( \frac{\alpha\beta\gamma\lambda}{\frac{c + K_{TR}}{d_b}} \right)$$

$$\frac{c + K_{TR}}{d_b} \le 2.5$$

$$l_d = l_{db} \left( \frac{A_{s,required}}{A_{s,provided}} \right) \ge 12''$$

[ACI-530•1.12.3,2.1.8] Masonry Walls

Standard Hooks

$$l_d = 0.0015 d_b F_s \ge 12 \text{ in.}$$

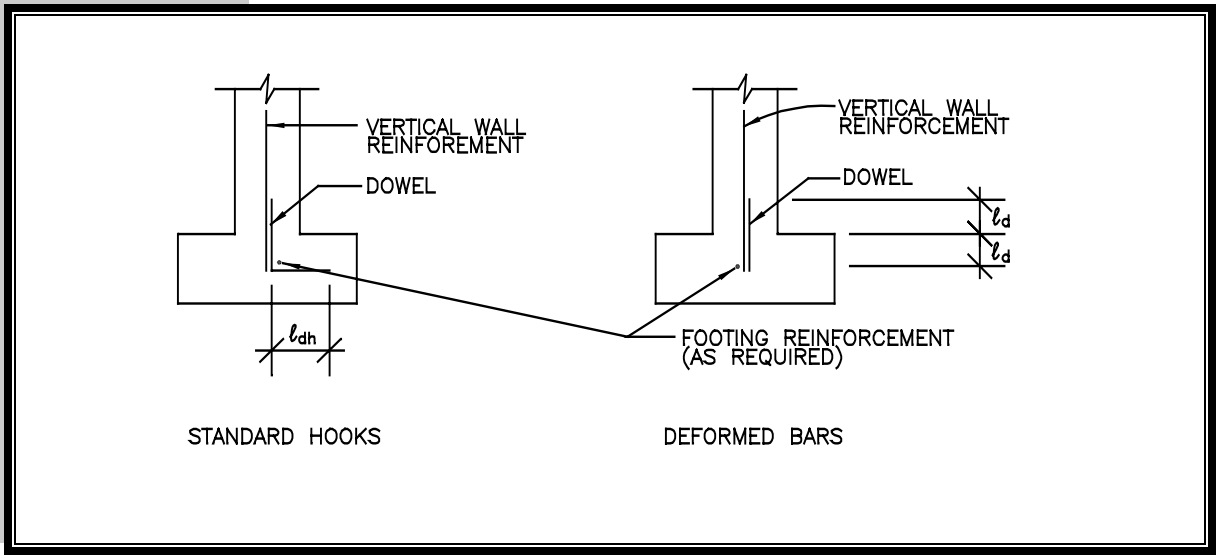
$$l_e = 11.25 d_b$$

Deformed Bars

$$l_d = \text{maximum } \{12 d_b\}$$

$$l_d = \text{maximum } \{12 d_b\}$$

***FIGURE 7.7 Dowel Placement in Concrete Footings***




The minimum embedment length is a limit specified in ACI-318 that is not necessarily compatible with residential construction conditions and practice. Therefore, this guide suggests a minimum embedment length of 6 to 8 inches for footing dowels, when necessary, in residential construction applications. In addition, dowels are sometimes used in residential construction to connect other concrete elements, such as porch slabs or stairs, to the house foundation to control differential movement. However, exterior concrete "flat work" adjacent to a home should be founded on adequate soil bearing or reasonably compacted backfill. Finally, connecting exterior concrete work to the house foundation requires caution, particularly in colder climates and soil conditions where frost heave may be a concern.