

## 11.4 Combined Lateral and Withdrawal Loads

### 11.4.1 Lag Screws and Wood Screws

When a lag screw or wood screw is subjected to combined lateral and withdrawal loading, as when the fastener is inserted perpendicular to the fiber and the load acts at an angle,  $\alpha$ , to the wood surface (see Figure 11F), the adjusted design value shall be determined as follows (see Appendix J):

$$Z'_\alpha = \frac{(W'p)Z'}{(W'p)\cos^2\alpha + Z'\sin^2\alpha} \quad (11.4-1)$$

where:

$\alpha$  = angle between wood surface and direction of applied load

$p$  = length of thread penetration in main member, in.

### 11.4.2 Nails and Spikes

When a nail or spike is subjected to combined lateral and withdrawal loading, as when the nail or spike

is inserted perpendicular to the fiber and the load acts at an angle,  $\alpha$ , to the wood surface, the adjusted design value shall be determined as follows:

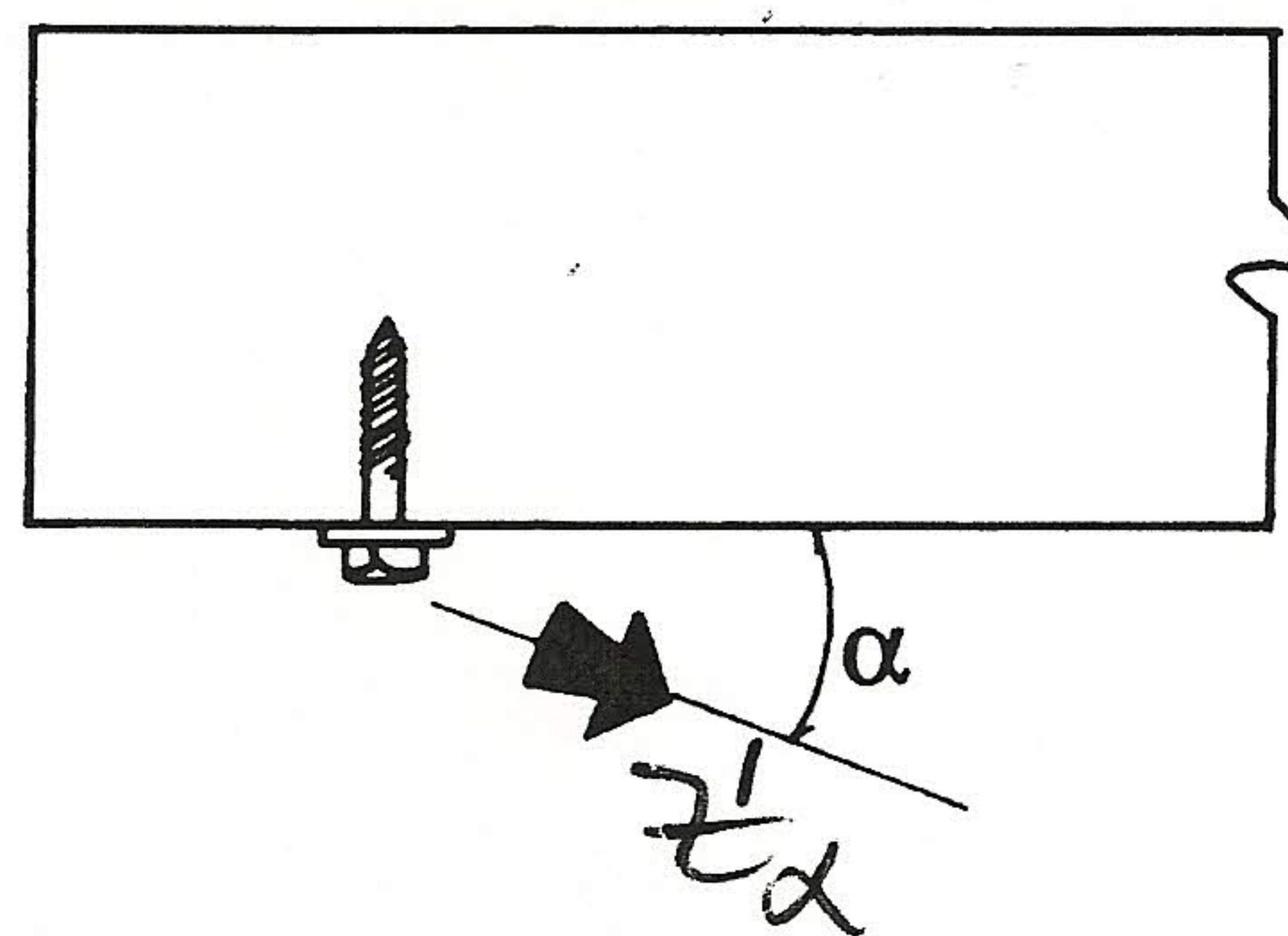
$$Z'_\alpha = \frac{(W'p)Z'}{(W'p)\cos\alpha + Z'\sin\alpha} \quad (11.4-2)$$

where:

$\alpha$  = angle between wood surface and direction of applied load

$p$  = length of penetration in main member, in.

**Figure 11F Combined Lateral and Withdrawal Loading**



## 11.5 Adjustment of Reference Design Values

### 11.5.1 Geometry Factor, $C_\Delta$

11.5.1.1 When  $D < 1/4"$ ,  $C_\Delta = 1.0$ .

11.5.1.2 When  $D \geq 1/4"$  and the end distance or spacing provided for dowel-type fasteners is less than the minimum required for  $C_\Delta = 1.0$  for any condition in (a), (b), or (c), reference design values shall be multiplied by the smallest applicable geometry factor,  $C_\Delta$ , determined in (a), (b), or (c). The smallest geometry factor for any fastener in a group shall apply to all fasteners in the group. For multiple shear connections or for asymmetric three member connections, the smallest geometry factor,  $C_\Delta$ , for any shear plane shall apply to all fasteners in the connection. Provisions for  $C_\Delta$  are based on an assumption that edge distance and spacing between rows of fasteners is in accordance with Table 11.5.1A and Table 11.5.1D and applicable requirements of 11.1.

**Table 11.5.1A Edge Distance Requirements<sup>1,2</sup>**

Direction of Loading	Minimum Edge Distance
Parallel to Grain:	
when $\ell/D \leq 6$	1.5D
when $\ell/D > 6$	1.5D or $1/2$ the spacing between rows, whichever is greater
Perpendicular to Grain: <sup>2</sup>	
loaded edge	4D
unloaded edge	1.5D

1. The  $\ell/D$  ratio used to determine the minimum edge distance shall be the lesser of:

(a) length of fastener in wood main member/ $D = \ell_m/D$

(b) total length of fastener in wood side member(s)/ $D = \ell_s/D$

2. Heavy or medium concentrated loads shall not be suspended below the neutral axis of a single sawn lumber or structural glued laminated timber beam except where mechanical or equivalent reinforcement is provided to resist tension stresses perpendicular to grain (see 3.8.2 and 10.1.3).

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