



and fourth load combinations are essentially combined bending and axial loads that may govern stud design as opposed to axial load only in the first two load combinations. Chapter 6 addresses the design of walls for in-plane shear or racking forces resulting from lateral building loads caused by wind or earthquakes.

In many cases, certain design load combinations or load components can be dismissed or eliminated through practical consideration and inspection. They are a matter of designer judgment, experience, and knowledge of the critical design conditions.

5.5.2 Load-Bearing Walls

Exterior load-bearing walls support both axial and lateral loads. For interior load-bearing walls, only gravity loads are considered. A serviceability check using a lateral load of 5 psf is sometimes applied independently to interior walls but should not normally control the design of load-bearing framing. This section focuses on the axial and lateral load-bearing capacity of exterior and interior walls.

Exterior walls are not necessarily load-bearing walls. Load-bearing walls support gravity loads from either the roof, ceiling, or floor joists or the beams above. A gable-end wall is typically considered to be a nonload-bearing wall in that roof and floor framing generally runs parallel to the gable end; however, it must support lateral wind and seismic loads and even small dead and live loads. Exterior load-bearing walls must be designed for axial loads as well as for lateral loads from wind or seismic forces. They must also act as shear walls to resist racking loads from lateral wind or seismic forces on the overall building (refer to Chapter 6). Example 5.6 demonstrates the design of an exterior bearing wall.

When calculating the column stability factor for a stud wall, note that column capacity is determined by using the slenderness ratio about the strong axis of the stud $(l_e/d)_x$ in accordance with NDS•3.7.1. The reason for using the strong axis slenderness ratio is that lateral support is provided to the stud by the wall sheathing and finish materials in the stud's weak-axis bending or buckling direction. When determining the column stability factor, C_p , for a wall system rather than for a single column in accordance with NDS•3.7.1, the designer must exercise judgment with respect to the calculation of the effective length, l_e , and the depth or thickness of the wall system, d . A buckling coefficient, K_e , of about 0.8 is reasonable (see Appendix G of NDS) and is supported in the research literature on this topic for sheathed wall assemblies and studs with square-cut ends (i.e., not a pinned joint).

In cases where continuous support is not present (e.g., during construction), the designer may want to consider stability for both axes. Unsupported studs generally fail due to weak-axis buckling under a significantly lower load than would otherwise be possible with continuous lateral support in the weak-axis buckling direction.

Interior walls may be either load-bearing or nonload-bearing. Nonload-bearing interior walls are often called partitions (see Section 5.5.3). In either case, interior walls should be solidly fastened to the floor and ceiling framing and to the exterior wall framing where they abutt. It may be necessary to install extra studs,



blocking, or nailers in the outside walls to provide for attachment of interior walls. The framing must also be arranged to provide a nailing surface for wallcovering materials at inside corners. For efficient construction details and concepts related to wall framing, refer to *Cost Effective Home Building: A Design and Construction Handbook* (NAHB, 1994).

Interior load-bearing walls typically support the floor or ceiling joists above when the clear span from exterior wall to exterior wall is greater than the spanning capability of the floor or ceiling joists. Interior walls, unlike exterior walls, seldom experience large transverse (i.e., out of plane) lateral loads; however, some building codes require interior walls to be designed for a minimum lateral load, such as 5 psf, for serviceability. If the interior wall is required only to resist axial loads, the designer may follow the design procedure demonstrated in Example 5.6 for the axial-load-only case. Generally, axial load design provides more-than-adequate resistance to a nominal lateral load.

If local code requirements do require wall studs to be designed to withstand a minimum lateral load, the designer should design load-bearing walls in accordance with the previous section on exterior load bearing walls. (Note that the load duration factor, C_D , of 1.6 is used for exterior load bearing walls when wind or earthquake loads are considered, whereas a load duration factor of 1.0 to 1.25 may be used for interior load-bearing walls and exterior walls analyzed for live and snow loads; refer to Section 5.2.4.1.)

5.5.3 NonLoad-Bearing Partitions

Interior partitions are not intended to support structural loads. Standard 2x4 or 2x3 wood stud interior partition walls are well proven in practice and do not require analysis. Openings within partitions do not require headers or trimmers and are commonly framed with single studs and horizontal members of the same size as the studs. Particularly in the case of closets, or other “tight” spaces, builders may frame certain partitions with smaller lumber, such as 2x2 studs or 2x4 studs turned flatwise to save space.

Where a minimum 5 psf lateral load check for serviceability is required in a nonload-bearing partition, the stud may be designed as a bending member or system similar to a simply supported floor joist, except that the only load is a 5 psf load uniformly distributed. The design approach and system factors in Sections 5.2 and 5.3 apply as appropriate.

5.5.4 Headers

Load-bearing headers are horizontal members that carry loads from a wall, ceiling, or floor or roof above and transfer the combined load to jack and king studs on each side of a window or door opening. The span of the header may be taken as the width of the rough opening measured between the jack studs supporting the ends of the header. Headers are usually built up from two nominal 2-inch-thick members.

Load-bearing header design and fabrication is similar to that for girders (see Section 5.4.3). This guide considers headers consisting of double members to be repetitive members; therefore, a repetitive member factor, C_r , of 1.1 to 1.2