span for floors subjected to full nominal live load and 1/240 of the span for roof members. Deflections of about 1/300 of the span (for cantilevers, 1/150 of the length) are visible and may lead to general architectural damage or cladding leakage. Deflections greater than 1/200 of the span may impair operation of movable components such as doors, windows, and sliding partitions.

In certain long-span floor systems, it may be necessary to place a limit (independent of span) on the maximum deflection to minimize the possibility of damage of adjacent nonstructural elements (ISO 1977). For example, damage to nonload-bearing partitions may occur if vertical deflections exceed more than about 10 mm (3/8 in.) unless special provision is made for differential movement (Cooney and King 1988); however, many components can and do accept larger deformations.

Load combinations for checking static deflections can be developed using first-order reliability analysis (Galambos and Ellingwood 1986). Current static deflection guidelines for floor and roof systems are adequate for limiting surficial damage in most buildings. A combined load with an annual probability of 0.05 of being exceeded would be appropriate in most instances. For serviceability limit states involving visually objectionable deformations, repairable cracking or other damage to interior finishes, and other short-term effects, the suggested load combinations are:

$$D + L \qquad \text{(CC-1a)}$$

$$D + 0.5S \qquad \text{(CC-1b)}$$

For serviceability limit states involving creep, settlement, or similar long-term or permanent effects, the suggested load combination is

$$D + 0.5L \qquad \text{(CC-2)}$$

The dead load effect, D, used in applying Eqs. CC-1 and CC-2 may be that portion of dead load that occurs after attachment of nonstructural elements. Live load, L, is defined in Chapter 4. For example, in composite construction, the dead load effects frequently are taken as those imposed after the concrete has cured; in ceilings, the dead load effects may include only those loads placed after the ceiling structure is in place.

CC.1.2 Drift of Walls and Frames

Drifts (lateral deflections) of concern in serviceability checking arise primarily from the effects of wind. Drift limits in common usage for building design are on the order of 1/600 to 1/400 of the building or story height (ASCE Task Committee on Drift Control of Steel Building Structures 1988 and Griffis 1993). These limits generally are sufficient to minimize damage to cladding and nonstructural walls and partitions. Smaller drift limits may be appropriate if the cladding is brittle. West and Fisher (2003) contains recommendations for higher drift limits that have successfully been used in low-rise buildings with various cladding types. It also contains recommendations for buildings containing cranes. An absolute limit on story drift may also need to be imposed in light of evidence that damage to nonstructural partitions, cladding, and glazing may occur if the story drift exceeds about 10 mm (3/8 in.) unless special detailing practices are made to tolerate movement (Freeman 1977 and Cooney and King 1988). Many components can accept deformations that are significantly larger.

Use of the nominal (700-year mean recurrence interval (MRI) or 1,700-year MRI) wind load in checking serviceability is excessively conservative. The following load combination, derived similarly to Eqs. CC-1a and CC-1b, can be used to check short-term effects:

$$D + 0.5L + W_a \qquad \text{(CC-3)}$$

in which W_a is wind load based on serviceability wind speeds in Figs. CC-1 through CC-4. Some designers have used a 10-year MRI (annual probability of 0.1) for checking drift under wind loads for typical buildings (Griffis 1993), whereas others have used a 50-year MRI (annual probability of 0.02) or a 100-year MRI (annual probability of 0.01) for more drift-sensitive buildings. The selection of the MRI for serviceability evaluation is a matter of engineering judgment that should be exercised in consultation with the building client.

The maps included in this appendix are appropriate for use with serviceability limit states and should not be used for strength limit states. Because of its transient nature, wind load need not be considered in analyzing the effects of creep or other long-term actions.

Deformation limits should apply to the structural assembly as a whole. The stiffening effect of nonstructural walls and partitions may be taken into account in the analysis of drift if substantiating information regarding their effect is available. Where load cycling occurs, consideration should be given to the possibility that increases in residual deformations may lead to incremental structural collapse.

CC.1.3 Vibrations

Structural motions of floors or of the building as a whole can cause the building occupants discomfort.