CODE

COMMENTARY

Shear keys provide a means of transferring shear but will not be engaged until slippage occurs.

9.3.3 *Reinforcement strain limit in nonprestressed beams*

9.3.3.1 Nonprestressed beams with $P_u < 0.10f_c'A_g$ shall be tension controlled in accordance with Table 21.2.2.

R9.3.3 *Reinforcement strain limit in nonprestressed beams*

R9.3.3.1 The effect of this limitation is to restrict the reinforcement ratio in nonprestressed beams to mitigate brittle flexural behavior in case of an overload. This limitation does not apply to prestressed beams. Before the 2019 Code, a minimum strain limit of 0.004 was specified for nonprestressed flexural members. Beginning with the 2019 Code, this limit is revised to require that the section be tension-controlled.

9.3.4 *Stress limits in prestressed beams*

9.3.4.1 Prestressed beams shall be classified as Class U, T, or C in accordance with 24.5.2.

9.3.4.2 Stresses in prestressed beams immediately after transfer and at service loads shall not exceed permissible stresses in 24.5.3 and 24.5.4.

9.4—Required strength
9.4.1 *General*

9.4.1.1 Required strength shall be calculated in accordance with the factored load combinations in Chapter 5.

9.4.1.2 Required strength shall be calculated in accordance with the analysis procedures in Chapter 6.

9.4.1.3 For prestressed beams, effects of reactions induced by prestressing shall be considered in accordance with 5.3.11.

9.4.2 *Factored moment*

9.4.2.1 For beams built integrally with supports, M_u at the support shall be permitted to be calculated at the face of support.

9.4.3 *Factored shear*

9.4.3.1 For beams built integrally with supports, V_u at the support shall be permitted to be calculated at the face of support.

9.4.3.2 Sections between the face of support and a critical section located d from the face of support for nonprestressed beams and $h/2$ from the face of support for prestressed beams shall be permitted to be designed for V_u at that critical section if (a) through (c) are satisfied:

(a) Support reaction, in direction of applied shear, introduces compression into the end region of the beam

R9.4—Required strength

R9.4.3 *Factored shear*

R9.4.3.2 The closest inclined crack to the support of the beam in Fig. R9.4.3.2a will extend upward from the face of the support reaching the compression zone approximately d from the face of the support. If loads are applied to the top of the beam, the stirrups across this crack need only resist the shear force due to loads acting beyond d (right free body in Fig. R9.4.3.2a). The loads applied to the beam between the face of the support and the point d away from the face