CODE

Table 9.3.1.1—Minimum depth of nonprestressed beams

Support condition	Minimum $h^{[1]}$
Simply supported	$\ell/16$
One end continuous	$\ell/18.5$
Both ends continuous	$\ell/21$
Cantilever	$\ell/8$

[1]Expressions applicable for normalweight concrete and f_y = 420 MPa. For other cases, minimum h shall be modified in accordance with 9.3.1.1.1 through 9.3.1.1.3, as appropriate.

9.3.1.1.1 For f_y other than 420 MPa, the expressions in Table 9.3.1.1 shall be multiplied by **$(0.4 + f_y/700)$**.

9.3.1.1.2 For nonprestressed beams made of lightweight concrete having w_c in the range of 1440 to 1840 kg/m³, the expressions in Table 9.3.1.1 shall be multiplied by the greater of (a) and (b):

(a) **$1.65 - 0.0003w_c$**
(b) **1.09**

9.3.1.1.3 For nonprestressed composite beams made of a combination of lightweight and normalweight concrete, shored during construction, and where the lightweight concrete is in compression, the modifier of 9.3.1.1.2 shall apply.

9.3.1.2 The thickness of a concrete floor finish shall be permitted to be included in h if it is placed monolithically with the beam or if the floor finish is designed to be composite with the beam in accordance with 16.4.

9.3.2 *Calculated deflection limits*

9.3.2.1 For nonprestressed beams not satisfying 9.3.1 and for prestressed beams, immediate and time-dependent deflections shall be calculated in accordance with 24.2 and shall not exceed the limits in 24.2.2.

9.3.2.2 For nonprestressed composite concrete beams satisfying 9.3.1, deflections occurring after the member becomes composite need not be calculated. Deflections occurring before the member becomes composite shall be investigated unless the precomposite depth also satisfies 9.3.1.

COMMENTARY

R9.3.1.1.1 The modification for f_y is approximate, but should provide conservative results for typical reinforcement ratios and for values of f_y between 280 and 690 MPa.

R9.3.1.1.2 The modification for lightweight concrete is based on the results and discussions in ACI 213R. No correction is given for concretes with w_c greater than 1840 kg/m³ because the correction term would be close to unity in this range.

R9.3.2 *Calculated deflection limits*

R9.3.2.2 The limits in Table 9.3.1.1 apply to the entire depth of nonprestressed composite beams shored during construction so that, after removal of temporary supports, the dead load is resisted by the full composite section. In unshored construction, the beam depth of concern depends on if the deflection being considered occurs before or after the attainment of effective composite action.

Additional deflections due to excessive creep and shrinkage caused by premature loading should be considered. This is especially important at early ages when the moisture content is high and the strength is low.

The transfer of horizontal shear by direct bond is important if excessive deflection from slippage is to be prevented.

9 Beams