CODE

(c) For members with $\boldsymbol{A_{ps}f_{se} \geq 0.4(A_{ps}f_{pu} + A_s f_y)}$,

$$V_{ci} = 0.17\lambda\sqrt{f_c'}b_w d \qquad (22.5.6.3.1c)$$

where d_p need not be taken less than $\mathbf{0.80}h$, the values of M_{max} and V_i shall be calculated from the load combinations causing maximum factored moment to occur at section considered, and M_{cre} shall be calculated by:

$$M_{cre} = \left(\frac{I}{y_t}\right)(0.5\lambda\sqrt{f_c'} + f_{pe} - f_d) \qquad (22.5.6.3.1d)$$

22.5.6.3.2 The web-shear strength V_{cw} shall be calculated by:

$$V_{cw} = (0.29\lambda\sqrt{f_c'} + 0.3f_{pc})b_w d_p + V_p \qquad (22.5.6.3.2)$$

COMMENTARY

plus an additional increment of shear required to change the flexural crack to a flexure-shear crack. The externally applied factored loads, from which V_i and M_{max} are determined, include superimposed dead load and live load. In calculating M_{cre} for substitution into Eq. (22.5.6.3.1a), I and y_t are the properties of the section resisting the externally applied loads.

For a composite member, where part of the dead load is resisted by only a part of the section, appropriate section properties should be used to calculate f_d. The shear due to dead loads, V_d, and that due to other loads, V_i, are separated in this case. V_d is then the total shear force due to unfactored dead load acting on that part of the section resisting the dead loads acting prior to composite action plus the unfactored superimposed dead load acting on the composite member. The terms V_i and M_{max} may be taken as

$$V_i = V_u - V_d \qquad (R22.5.6.3.1b)$$

$$M_{max} = M_u - M_d \qquad (R22.5.6.3.1c)$$

where V_u and M_u are the factored shear and moment due to the total factored loads, and M_d is the moment due to unfactored dead load (the moment corresponding to f_d).

For noncomposite, uniformly loaded beams, the total cross section resists all the shear, and the live and dead load shear force diagrams are similar. In this case, Eq. (22.5.6.3.1a) and Eq. (22.5.6.3.1d) reduce to

$$V_{ci} = 0.05\lambda\sqrt{f_c'}b_w d + \frac{V_u M_{ct}}{M_u} \qquad (R22.5.6.3.1d)$$

where

$$M_{ct} = (I/y_t)(0.5\lambda\sqrt{f_c'} + f_{pe}) \qquad (R22.5.6.3.1e)$$

The cracking moment M_{ct} in the two preceding equations represents the total moment, including dead load, required to cause cracking at the extreme fiber in tension. This is not the same as M_{cre} in Eq. (22.5.6.3.1a) where the cracking moment is that due to all loads except the dead load. In Eq. (22.5.6.3.1a), the dead load shear is added as a separate term.

M_u is the factored moment on the beam at the section under consideration, and V_u is the factored shear force occurring simultaneously with M_u. Because the same section properties apply to both dead and live load stresses, there is no need to calculate dead load stresses and shears separately. M_{ct} reflects the total stress change from effective prestress to a tension of $\mathbf{0.5}\lambda\sqrt{f_c'}$, assumed to cause flexural cracking.

R22.5.6.3.2 Equation (22.5.6.3.2) is based on the assumption that web-shear cracking occurs at a shear level causing a principal tensile stress of approximately $\mathbf{0.33}\lambda\sqrt{f_c'}$ at the centroidal axis of the cross section. V_p is calculated from the effective prestress force without load factors.

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