CODE

COMMENTARY

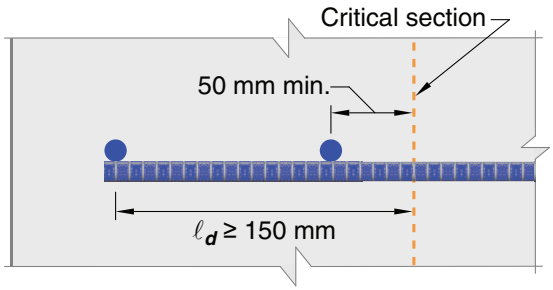

***Fig. R25.4.7.2**—Development of welded plain wire reinforcement.*

25.4.8 *Development of pretensioned seven-wire strands in tension*

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Development requirements for pretensioned strand are intended to provide bond integrity for the strength of the member. Provisions are based on tests performed on normal-weight concrete members with a minimum cover of 50 mm. These tests may not represent the behavior of strand in no-slump concrete. Concrete placement operations should ensure consolidation of concrete around the strand with complete contact between the steel and concrete.

The bond of strand is a function of a number of factors, including the configuration and surface condition of the steel, the stress in the steel, the depth of concrete beneath the strand, and the method used to transfer the force in the strand to the concrete. For bonded applications, quality assurance procedures should be used to confirm that the strand is capable of adequate bond (Rose and Russell 1997; Logan 1997). The precast concrete manufacturer may rely on certification from the strand manufacturer that the strand has bond characteristics that comply with this section.

This section does not apply to plain wires, to end-anchored tendons, or to unstressed strand. The development length for plain wire could be considerably greater due to the absence of mechanical interlock. Flexural bond failure would occur with plain wire when first slip occurred. Nontensioned prestressing steel is sometimes used as integrity reinforcement in precast concrete structures; however, there are limited data available regarding the bond length required to ensure development of the yield strength of the reinforcement (Salmons and McCrate 1977; PCA 1980).

25.4.8.1 Development length ℓ_d of pretensioned seven-wire strands in tension shall be in accordance with (a) and (b):

(a) $$\ell_d = \left(\frac{f_{se}}{21}\right)d_b + \left(\frac{f_{ps} - f_{se}}{7}\right)d_b \qquad (25.4.8.1)$$

(b) If bonding of a strand does not extend to end of member, and design includes tension at service loads in the precompressed tension zone, ℓ_d calculated by Eq. (25.4.8.1) shall be doubled.

R25.4.8.1 The first term in Eq. (25.4.8.1) represents the transfer length of the strand, that is, the distance over which the strand should be bonded to the concrete to develop the effective prestress in the prestressed reinforcement, f_{se}. The second term represents the additional length over which the strand should be bonded so that the stress in the prestressed reinforcement at nominal strength of the member, f_{ps}, may develop.

Exploratory tests (Kaar and Magura 1965) that studied the effect of debonded strand (bond not permitted to extend to the ends of members) on performance of pretensioned girders indicated that the performance of these girders with