CODE

COMMENTARY

In deep beams, hairpin bars spliced with the tie reinforcement can be used to anchor the tie forces at exterior supports, provided the beam width is large enough to accommodate such bars.

Figure R23.8.2 shows two ties anchored at a nodal zone. Development is required where the centroid of the tie crosses the outline of the extended nodal zone.

The development length of the tie reinforcement can be reduced through hooks, headed bars, mechanical devices, additional confinement, or by splicing it with layers of smaller bars.

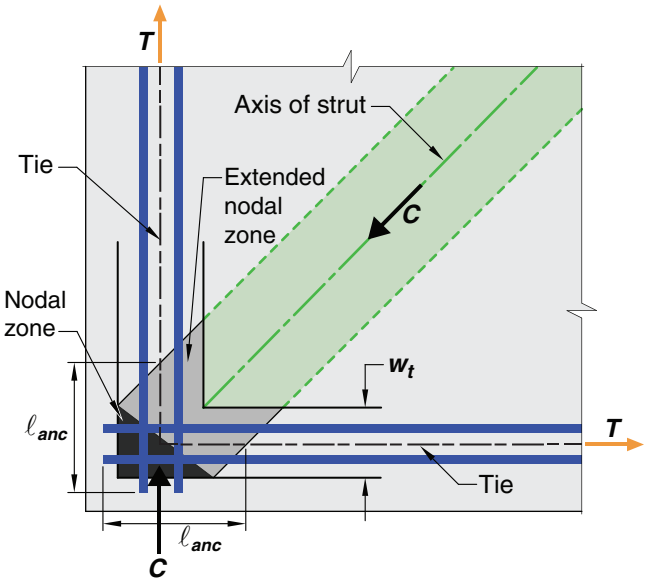

***Fig. R23.8.2**—Extended nodal zone anchoring two ties.*

23.8.3 Tie force shall be developed in each direction at the point where the centroid of the reinforcement in the tie leaves the extended nodal zone.

23.9—Strength of nodal zones

23.9.1 The nominal compressive strength of a nodal zone, F_{nn}, shall be calculated by:

$$F_{nn} = f_{ce}A_{nz} \quad (23.9.1)$$

where f_{ce} is defined in 23.9.2 or 23.9.3 and A_{nz} is given in 23.9.4 or 23.9.5.

23.9.2 The effective compressive strength of concrete at a face of a nodal zone, f_{ce}, shall be calculated by:

$$f_{ce} = 0.85\beta_c\beta_n f_c' \quad (23.9.2)$$

where β_n shall be in accordance with Table 23.9.2 and β_c is in accordance with Table 23.4.3(b).

R23.9—Strength of nodal zones

R23.9.2 The nodes in two-dimensional models can be classified as shown in Fig. R23.2.6c. The effective compressive strength of the nodal zone is given by Eq. (23.9.2) where the value for β_n is given in Table 23.9.2.

Lower β_n values reflect the increasing degree of disruption of the nodal zones due to the incompatibility of tensile strains in the ties and compressive strains in the struts. The stress on any face of the nodal zone or on any section through the nodal zone should not exceed the value given by Eq. (23.9.2).