CODE

23.2.2 Geometry of the idealized truss shall be consistent with the dimensions of the struts, ties, nodal zones, bearing areas, and supports.

COMMENTARY

R23.2.2 The struts, ties, and nodal zones making up the strut-and-tie model all have finite widths, typically in the plane of the model, and thicknesses, typically the out-of-plane dimension of the structure, which should be taken into account in selecting the dimensions of the truss. Figures R23.2.2(a) and (b) show a node and the corresponding nodal zone. The vertical and horizontal forces equilibrate the forces in the inclined strut.

If more than three forces act on a nodal zone in a two-dimensional strut-and-tie model, as shown in Fig. R23.2.2b, it is suggested to resolve some of the forces to form three intersecting forces. The strut forces acting on Faces A-E and C-E in Fig. R23.2.2(a) can be replaced with one force acting on Face A-C as shown in Fig. R23.2.2(b). This force passes through the node at D.

Alternatively, the strut-and-tie model can be analyzed assuming all the strut forces act through the node at D, as shown in Fig. R23.2.2(c). In this case, the forces in the two struts on the right side of Node D can be resolved into a single force acting through Point D, as shown in Fig. R23.2.2(d).

If the width of the support in the direction perpendicular to the member is less than the width of the member, transverse reinforcement may be required to restrain vertical splitting in the plane of the node. This can be modeled using a transverse strut-and-tie model.

R23.2.3 The analysis results from the strut-and-tie method represent lower-bound strength limit states. Section 23.5.1 requires distributed reinforcement in D-regions designed by this chapter unless struts are laterally restrained. Distributed reinforcement in D-regions will improve serviceability performance. In addition, crack widths in a tie can be controlled using 24.3.2, assuming the tie is encased in a prism of concrete corresponding to the area of the tie from R23.8.1.