6 Roof & Wall Bracing

6.1 GENERAL

Portal frames resist transverse wind forces by in-plane flexure, but longitudinal wind forces acting on the end walls must be transferred via roof bracing to the side walls and thence to the footings as shown in Figure 6.1.

Roof and wall bracing often consist of panels of double diagonals as shown in Figure 6.2. These members are so slender as to have negligible capacity in compression. Such members include pretensioned rods, slender tubes and angles. In the design of double diagonal tension bracing, one of each pair of diagonals acts in tension as shown in Figure 6.1, depending on the direction of wind loading. The other diagonal is ignored because it is not capable of taking compression loads. In addition to tension forces, roof bracing diagonals have to carry their own weight whether by cable action in the case of rods, or by beam action in the case of tubes and angles.

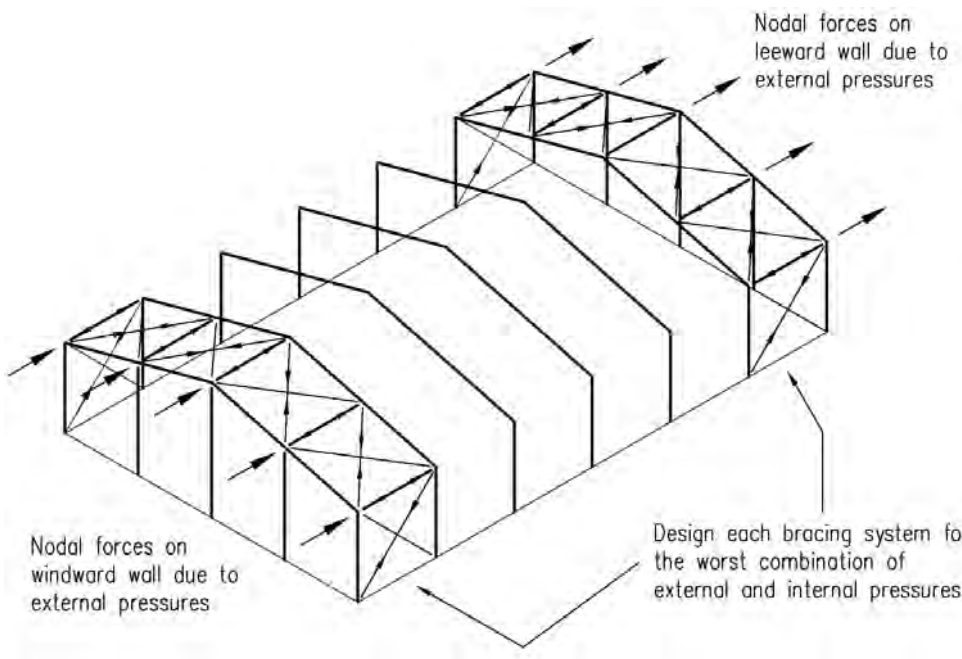

Figure 6.1 *Roof and Wall Bracing*

As common as tension bracing is, there is not a widely accepted method of design which accounts for tension and self-weight. This problem was investigated in References [1] and [2], and the results are presented in this chapter.

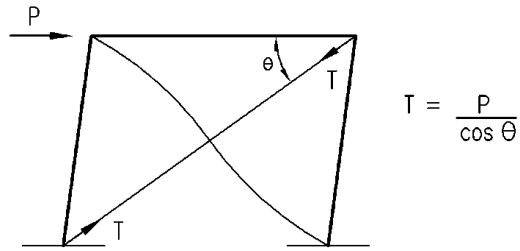

Figure 6.2 *Double Diagonal Bracing Module*

6.2 ERECTION PROCEDURE

Portal frames can collapse during construction if adequate care is not taken to use permanent or temporary bracing to withstand wind gusts and to stabilise the structure generally. The procedure to be used varies from building to building depending on the type and location of the permanent roof and wall bracing bays and whether the end wall frame is a braced frame or a portal frame. ASI Technical Note TN002 V2 [3] addresses some risks associated with erection and the issues with temporary bracing. It mentions a 2009 court finding following the collapse of a Victorian warehouse during construction and then summarises the responsibilities of the structural design engineer and the contractor.

For example, if the permanent bracing consists of single diagonal tension bracing in each end bay as shown in Figure 6.6(V), the structure will not be stable until the two ends are tied together by purlins. In this case, temporary diagonals would need to be used so that there is double diagonal bracing at each end until the two bracing bays are connected by purlins. It follows that such bracing is unlikely to be practical.

6.3 ROOF AND WALL BRACING FORCES

6.3.1 Longitudinal Wind Forces

The primary function of a triangulated roof and wall bracing system is to withstand longitudinal wind forces. By means of the bracing system, the forces on the upper half of the end walls, and the frictional drag forces on the roof and side walls, are transferred to the side wall bracing and thence to the footings.

6.3.2 Rafter or Truss Bracing Forces

6.3.2.1 GENERAL

The compression flanges of rafters and the compression chords of roof trusses also need to be restrained laterally as explained in Chapter 4 and the bracing forces may need to be combined with the longitudinal wind forces. The bracing forces from multiple rafters or trusses will accumulate to some extent and transmit to the roof bracing systems. To consider the load paths for the accumulated forces, it is helpful to first consider the stabilising of roof trusses

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Contents