5.1.3.3.3 One simple example comparing the methods

The simple examples shown in Fig. 5.1-6 should help you understand the differences between the three basic methods for computing wind on a tower. You can work out the examples by hand. The tower is a simple plane truss subjected to an artificial transverse wind pressure of 100 psf. All members have a wind width of 1 ft. The member forces and foundation reactions are indicated on the three sketches in the middle part of the figure for the three basic wind assumptions discussed below.

Standard wind on face only. With this assumption, there is only wind load on the members in the windward face (here Member A-C is the only one in the face). Members A-B, B-C and B-D are behind the face and are assumed sheltered. With an assumed *Transverse Drag Area Adjustment Factor for Face* equal to one (Input in the **Section** table of Fig. 4.4-1), the total wind load on Member A-C is 100 psf x 1 x 10 ft^2 = 1,000 lbs which is divided equally between its ends: 500 lbs on Joint A and 500 lbs on Joint C. You should be able to figure out the statics of the entire truss. The results are shown in the left middle portion of the figure.

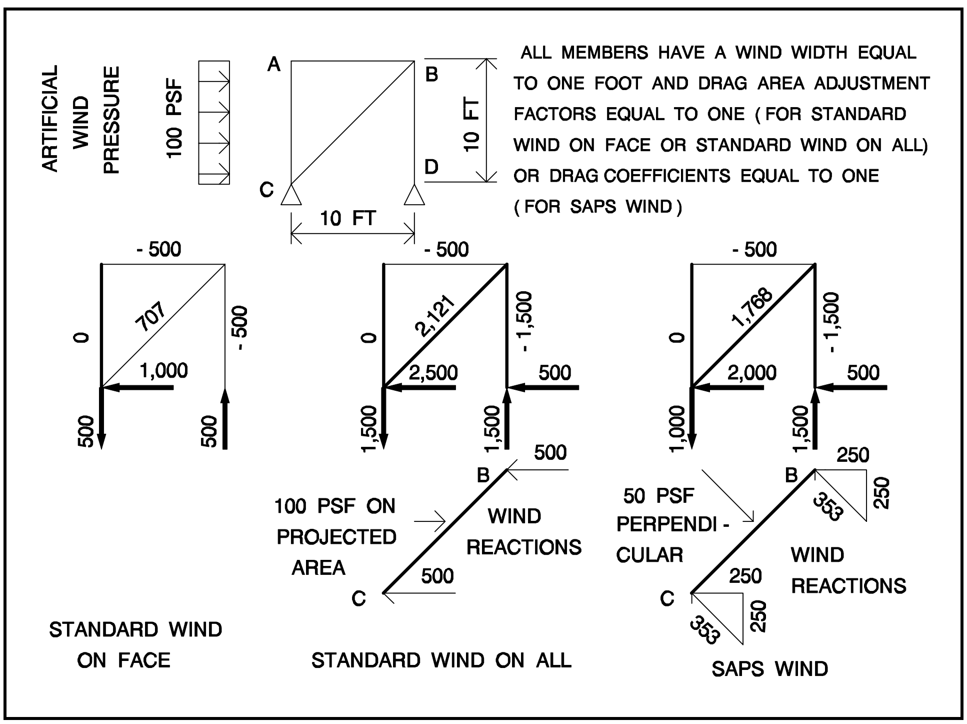

Fig. 5.1-6 Wind load examples

Standard wind on all members. With this assumption, there is no shielding by any member, i.e. the wind will blow on Members A-C, B-C and B-D (there is no wind load on Member A-B because it is parallel to the wind) as if they were alone. Even though Member B-C is inclined, its wind load is based on its projected area perpendicular to the wind, which is the same as that for Members A-C or B-D, i.e. 10 ft^2. With an assumed *Transverse Drag Area Adjustment Factor for All* equal to one (Input in the **Sections Properties** table of Fig. 4.4-1), the total wind load on each of Members A-C, B-C and B-D is 100 psf x 1 x 10 ft^2 = 1,000 lbs which is divided equally between their ends: 500 lbs at the top end and 500 lbs at the bottom end. The statics is worked out in the middle of the figure.

SAPS wind load. With this assumption, there is also no shielding by any member, i.e. the wind will blow on Members A-C, B-C and B-D (there is no wind load on Member A-B because it is parallel to the wind) as if they were alone. Because Member B-C is inclined, its wind load is based on a pressure of 50 psf (the pressure is adjusted by the square of the cosine of the wind incidence angle of 45 degrees according to Eq. 5-3) applied perpendicular to the member (see sketch at lower right of Fig. 5.1-6). With an assumed *Drag Coefficient for Angle Members* equal to one (Input in the **SAPS Wind Load** table of Fig. 5.1-5), the total wind load on Member B-C is 50 psf x 1 x 14.14 ft^2 = 707 lbs which is divided equally between its ends. The 353 lbs end reactions have horizontal and vertical components equal to 250 lbs as shown in the bottom right corner of Fig. 5.1-6.

It is obvious from the above examples that if you used the same value for drag area adjustment factors for the two standard methods and for the drag coefficients for the SAPS method, your total tower wind load would be the smallest for the "Standard wind on face" method, and would be more than twice as large for the "Standard wind on all members" and the "SAPS wind" methods. As discussed in Section 5.1.3.2, a good value for the *Drag Area Adjustment Factor for Face* is between 3.2 and 4.0 to account for the fact that angle members are not round and that some wind goes through the windward face and hits the back face. A realistic value for the *Drag Area Adjustment Factor for All* is generally between 1.2 and 1.6. The conservative value of 1.6 for the *Drag Coefficient* for the "SAPS wind" has been used.