

# Chapter 31

## WIND TUNNEL PROCEDURE

### 31.1 SCOPE

The Wind Tunnel Procedure shall be used where required by Sections 27.1.3, 28.1.3, and 29.1.3. The Wind Tunnel Procedure shall be permitted for any building or structure in lieu of the design procedures specified in Chapter 27 (MWFRS for buildings of all heights and simple diaphragm buildings with  $h \leq 160$  ft (48.8 m)), Chapter 28 (MWFRS of low-rise buildings and simple diaphragm low-rise buildings), Chapter 29 (MWFRS for all other structures), and Chapter 30 (components and cladding for all building types and other structures).

**User Note:** Chapter 31 may always be used for determining wind pressures for the MWFRS and/or for C&C of any building or structure. This method is considered to produce the most accurate wind pressures of any method specified in this Standard.

### 31.2 TEST CONDITIONS

Wind tunnel tests, or similar tests employing fluids other than air, used for the determination of design wind loads for any building or other structure, shall be conducted in accordance with this section. Tests for the determination of mean and fluctuating forces and pressures shall meet all of the following conditions:

1. The natural atmospheric boundary layer has been modeled to account for the variation of wind speed with height.
2. The relevant macro- (integral) length and micro-length scales of the longitudinal component of atmospheric turbulence are modeled to approximately the same scale as that used to model the building or structure.
3. The modeled building or other structure and surrounding structures and topography are geometrically similar to their full-scale counterparts, except that, for low-rise buildings meeting the requirements of Section 28.1.2, tests shall be permitted for the modeled building in a single exposure site as defined in Section 26.7.3.
4. The projected area of the modeled building or other structure and surroundings is less than 8

percent of the test section cross-sectional area unless correction is made for blockage.

5. The longitudinal pressure gradient in the wind tunnel test section is accounted for.
6. Reynolds number effects on pressures and forces are minimized.
7. Response characteristics of the wind tunnel instrumentation are consistent with the required measurements.

### 31.3 DYNAMIC RESPONSE

Tests for the purpose of determining the dynamic response of a building or other structure shall be in accordance with Section 31.2. The structural model and associated analysis shall account for mass distribution, stiffness, and damping.

### 31.4 LOAD EFFECTS

#### 31.4.1 Mean Recurrence Intervals of Load Effects

The load effect required for Strength Design shall be determined for the same mean recurrence interval as for the Analytical Method, by using a rational analysis method, defined in the recognized literature, for combining the directional wind tunnel data with the directional meteorological data or probabilistic models based thereon. The load effect required for Allowable Stress Design shall be equal to the load effect required for Strength Design divided by 1.6. For buildings that are sensitive to possible variations in the values of the dynamic parameters, sensitivity studies shall be required to provide a rational basis for design recommendations.

#### 31.4.2 Limitations on Wind Speeds

The wind speeds and probabilistic estimates based thereon shall be subject to the limitations described in Section 26.5.3.

#### 31.4.3 Limitations on Loads

Loads for the main wind force resisting system determined by wind tunnel testing shall be limited such that the overall principal loads in the  $x$  and  $y$  directions are not less than 80 percent of those that would be obtained from Part 1 of Chapter 27 or Part 1