Table C26.7-2 Davenport Classification of Effective Terrain Roughness

Class	z_o, ft (m) [note 1]	α [note 2]	z_g, ft (m) [note 2]	z_d (ft or m) [note 3]	Wind flow and landscape description[4]
1	0.0007 (0.0002)	12.9	509 (155)	$z_d = 0$	*"Sea"*: Open sea or lake (irrespective of wave size), tidal flat, snow-covered flat plain, featureless desert, tarmac and concrete, with a free fetch of several kilometers.
2	0.016 (0.005)	11.4	760 (232)	$z_d = 0$	*"Smooth"*: Featureless land surface without any noticeable obstacles and with negligible vegetation; e.g. beaches, pack ice without large ridges, marsh and snow-covered or fallow open country.
3	0.1 (0.03)	9.0	952 (290)	$z_d = 0$	*"Open"*: Level country with low vegetation (e.g. grass) and isolated obstacles with separations of at least 50 obstacle heights; e.g. grazing land without windbreaks, heather, moor and tundra, runway area of airports. Ice with ridges across-wind.
4	0.33 (0.10)	7.7	1,107 (337)	$z_d = 0$	*"Roughly open"*: Cultivated or natural area with low crops or plant covers, or moderately open country with occasional obstacles (e.g. low hedges, isolated low buildings or trees) at relative horizontal distances of at least 20 obstacle heights.
5	0.82 (0.25)	6.8	1,241 (378)	$z_d = 0.2z_H$	*"Rough"*: Cultivated or natural area with high crops or crops of varying height, and scattered obstacles at relative distances of 12 to 15 obstacle heights for porous objects (e.g. shelterbelts) or 8 to 12 obstacle heights for low solid objects (e.g. buildings).
6	1.64 (0.5)	6.2	1,354 (413)	$z_d = 0.5z_H$	*"Very Rough"*: Intensely cultivated landscape with many rather large obstacle groups (large farms, clumps of forest) separated by open spaces of about 8 obstacle heights. Low densely-planted major vegetation like bushland, orchards, young forest. Also, area moderately covered by low buildings with interspaces of 3 to 7 building heights and no high trees.
7	3.3 (1.0)	5.7	1,476 (450)	$z_d = 0.7z_H$	*"Skimming"*: Landscape regularly covered with similar-size large obstacles, with open spaces of the same order of magnitude as obstacle heights; e.g. mature regular forests, densely built-up area without much building height variation.
8	≥ 6.6 (≥ 2)	5.2	1,610 (490)	*Analysis by wind tunnel advised*	*"Chaotic"*: City centers with mixture of low-rise and high-rise buildings, or large forests of irregular height with many clearings. *(Analysis by wind tunnel advised)*

Notes:

1. The surface roughness length, z_o, represents the physical effect that roughness objects (obstacles to wind flow) on the earth's surface have on the shape of the atmospheric boundary layer wind velocity profile as determined by the logarithmic law and used in the ESDU model.
2. The power law uses α as the denominator in its exponent ($1/\alpha$) and the gradient height, z_g, representing the height at which geostrophic wind flow begins to occur, as the basis for determining the boundary layer wind velocity profile and velocity pressure exposure coefficients (see Section C27.3.1). The values provided in Table C26.7-2 are based on the published z_o values and use of Equations C27.3-3 and C27.3-4.
3. The zero plane displacement height, z_d, is the elevation above ground that the base of the logarithmic law (and power law) wind profile must be elevated to accurately depict the boundary layer wind flow. Below z_d and less than some fraction of the typical height, z_H, of obstacles causing roughness, the near ground wind flow is characterized as a turbulent exchange with the boundary layer wind flow above resulting in significant shielding effects under uniform to moderately uniform roughness conditions (e.g. Classes 5 through 7 in Table C26.7-2). In this condition, the effective mean roof height, h_{eff}, may then be determined as $h\text{-}z_d$ (but not less than 15 feet or 4.6 m) for the purpose of determining MWFRS wind loads acting on a building structure located within such a roughness class. Appropriate values of z_d for a given site may vary widely and those shown in Table C26.7-2 should be used with professional judgment. Because of the presence of highly turbulent flow at elevations near or below z_d (except perhaps structures embedded in uniform Class 7 roughness), use of an effective mean roof height should not be applied for the determination of components and cladding wind loads. In Class 8 roughness where wind flow disruptions can be highly non-uniform, channeling effects and otherwise "chaotic" wind flow patterns can develop between and below the height of obstacles to wind flow. For this reason, a wind tunnel study is generally advised.
4. Use of these wind flow and landscape descriptions should result in no greater than one roughness class error, corresponding to a maximum +/– 6% error in q_h.