

Wind Energy Loss Phenomenon Over Volumized Building Envelope with Porous Air Portals

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Abstract : More and more building envelopes consist of the construction of balconies, canopies, handrails, sun-shading, vertical planters or gardens, maintenance platforms, display devices, lightings, ornaments, and also the most commonly seen double skin system. These components form a uniform but three-dimensional disturbance structure and create a complex surface wind field in front of the actual watertight building interface. The distorted wind behavior would affect the façade performance and building ventilation. Comparing with sole windscreen walls, these three-dimensional structures perform like distributed air portal assembly, and each portal generates air turbulence and consume wind pressure and energy simultaneously. In this study, we attempted to compare the behavior of 2D porous windscreens without internal construction, porous tubular portal windscreens, porous tapered portal windscreens, and porous coned portal windscreens. The wind energy reduction phenomenon is then compared to the different distributed air portals. The experiments are conducted in a physical wind tunnel with 1:25 in scale to simulate the three-dimensional structure of a real building envelope. The experimental airflow was set up to smooth flow. The specimen is designed as a plane with a distributed tubular structure behind, and the control group uses different tubular shapes but the same fluid volume to observe the wind damping phenomenon of various geometries.

Keywords : volumized building envelope, porous air portal, wind damping, wind tunnel test, wind energy loss

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