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Narrative for Load Coefficients Based on CFD Analysis

Industrial Louvers has commissioned a study to determine allowable wind load reduction based on the porosity of Industrial Louvers' equipment screens. The intent of the wind load reduction is to reduce the reaction loads imposed on the structure which supports the equipment screens, thereby allowing the supporting structure designer to use lighter weight material. Design pressure reduction is allowed per ASCE 7 Section 6.4.3 or Section 6.5.2.2. Ultimately this will lead to reduced overall project costs.

The study consisted of comparing the load imposed on a flat wall to the load imposed on the Industrial Louvers' equipment screens due to moving air. See Figure 1 and Figure 2 for examples of velocity profiles. Both the flat wall and the equipment screens were analyzed in a 2-dimensional environment with slip conditions above and below. Atmospheric pressure was assumed, and air temperature was fixed at 23°C. Drag forces (wind loads) were calculated at air velocities of 90 mph, 130 mph, 170 mph, and 200 mph for both the flat wall and equipment screen. Horizontal and vertical load coefficients were then derived from the drag force data. IMAGINiT Technologies performed the CFD analysis.

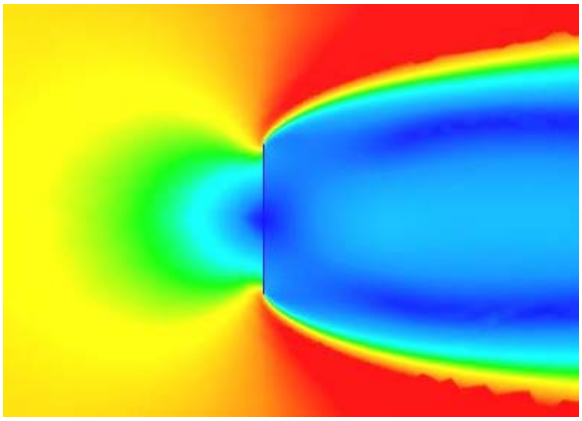

Figure 1: Velocity Profile – Flat Wall

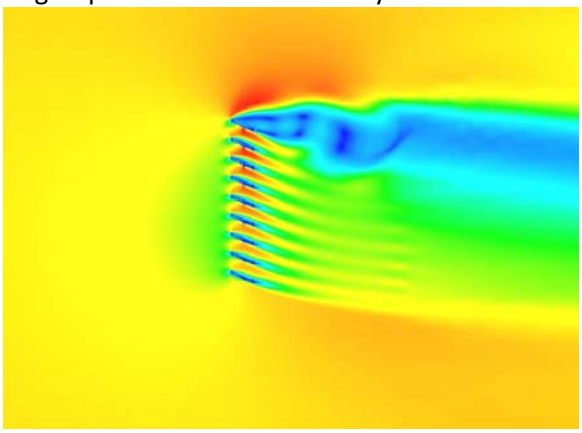

Figure 2: Velocity Profile – Equipment Screen

Loads imposed on the flat wall correspond with the components and cladding design pressures calculated per ASCE 7. With this understanding we can calculate more realistic reaction loads imposed on the supporting structure by taking the product of the horizontal reaction load as prescribed by ASCE 7 and the load coefficient. Not only can we calculate a more realistic horizontal reaction load, but some equipment screen models also develop a vertical load component due to the geometry of the equipment screen blades. The horizontal and vertical reaction load calculations are shown in Equations 1 and 2, respectively, where R' is the horizontal reaction load as calculated using the components and cladding design pressure per ASCE 7, HLC is the Horizontal Load Coefficient, and VLC is the Vertical Load Coefficient. HLC and VLC values can be found in the equipment screen product data and specification documents.

$$R_x = (HLC)R' \quad \text{(Equation 1)}$$

$$R_y = (VLC)R' \quad \text{(Equation 2)}$$