Effect of Opening Ratios with and Without Louvers in Cross Ventilation Using CFD

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Abstract As the world marches forward implementing concepts of sustainable buildings, higher reliance on natural ventilation can be obtained through louvers. In this research of cross ventilation in a generic isolated building, the leeward opening sizes were manipulated to 1:1, 1:0.25 and 1:0.5, with louver angles of 0°, 15°, 30°, 45° and no louvers. An Atmospheric Boundary Layer (ABL) condition was applied at the inlet of the flow domain and a 3D-steady Reynolds-Averaged Navier–Stokes (RANS) equation was solved with the Shear Stress Transport (SST) k-ω turbulence model. Mesh sensitivity analysis and model validation were performed as per best practices. The results show that as the size of the leeward opening decreases, the acceleration through the louver blades increases. In the absence and presence of louvers, as the windward-louver (W-L) ratio increased from 1:0.25 to 1:1, its dimensionless flow rate (DFR) increases. Highest DFR was obtained when the W-L ratio was 1:1 and the louver angle was 0°, second to louver angle of 15°, followed by the configuration without louvers present. Their respective DFR values were 0.588, 0.544 and 0.522. As the louver angle increased from 0° to 45°, the DFR reduced for all opening W-L ratios.

Keywords Louver · Cross ventilation · Opening ratio · CFD

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