

Investigation Air Flow Rate Using Centroids of Equal Area Method in University Workshop

Farisha Ilyana Zanuddin^a, Abd Rahman Mat Amin^{a*}

Structured Abstract

Background: Local Exhaust Ventilation (LEV) systems are essential for maintaining air quality in industrial and academic settings by capturing contaminants at their source. Despite their importance, many LEV systems are inadequately assessed, leading to inefficient pollutant removal and increased occupational risks. Traditional airflow measurement techniques like the Equal Area Method (EAM) are still widely used due to their simplicity, although more precise methods such as the Log-Tchebycheff Method have been introduced. This study was conducted at the Mechanical Engineering Workshop, UiTM Bukit Besi, to evaluate LEV system performance using the Equal Area Method and examine the impact of varying insertion points (6, 8, and 10) on airflow readings.

Methods: Measurements were conducted using a pitot tube and inclined manometer to assess velocity pressure (VP) across a 7-inch diameter duct. Insertion depths were calculated based on EAM principles, using centroid distances for 6, 8, and 10-point traverses. Data were collected at both front and side orientations of the duct. Air velocity (V) was derived from VP using Bernoulli's equation, and volumetric airflow rate (Q) was computed using the formula $Q = V \times A$, where A is the duct cross-sectional area. Comparisons were also drawn with theoretical expectations from the Log-Tchebycheff Method.

Results: Findings revealed that higher insertion counts yielded more stable and higher VP, V, and Q values. The 10-point traverse recorded the highest air velocity (2190.58 fpm) and airflow rate (159.95 CFM), suggesting greater accuracy. The study also noted that airflow was not uniformly distributed, with significant differences between front and side readings, likely due to duct layout and resistance. The Equal Area Method proved effective for basic assessments but showed limitations in turbulent or non-uniform flows.

Conclusion: The study demonstrates that while the Equal Area Method is accessible and educationally practical, incorporating more insertion points significantly improves measurement accuracy. The findings support routine LEV performance checks and emphasize the importance of selecting appropriate assessment methods for maintaining safe indoor air quality.

Keywords: Local Exhaust Ventilation, Equal Area Method, Velocity Pressure, Airflow Rate, Pitot Tube

*Correspondence: abdra401@uitm.edu.my

^aSchool of Chemistry & Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia