CEE 342 Laboratory Exercise:
Test of Fluid Mass Conservation (Continuity) for Steady-State Air Flow
## 206 Harris Hydraulics Laboratory

Objectives

- To demonstrate the use of a piezometer and the principles underlying the operation of a pitot tube;

- To acquire a basic physical understanding of the Bernoulli equation and the inter-conversion of different forms of energy in fluids; and

- To improve understanding of the continuity equation, and assess how accurately our measurements are at confirming it.

Apparatus and Procedure

Measurements will be taken in a 7-inch × 7-inch air duct shown schematically in Figure 1. Velocities will be determined indirectly with a pitot-static tube connected to a U-tube manometer. The device is calibrated to indicate velocities of air at room temperature in feet per minute (fpm).

Take velocity measurements along the vertical centerline of the duct shown in Figure 1 at:

1) Station A-A: at $y = 1/2$, 1-1/2, 2-1/2, 3-1/2, 4-1/2, 5-1/2, and 6-1/2 inches, and
2) Station B-B: at $y = 1/4$, 3/4 1-1/4, 1-3/4, 2-1/4, 2-3/4, and 3-1/4 inches.
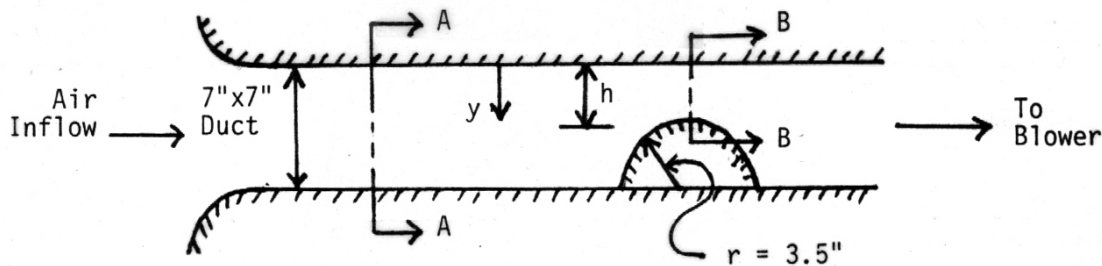
Figure 1. Longitudinal Vertical Section Schematic of 7-inch x 7-inch Plexiglas Air Duct Showing Measurement Stations A-A and B-B.

Report
<u>Report</u>

Please include the following items in a brief report, in the following sequence:

1) Laboratory data sheet.

2) Neat plots, computer-generated or on coordinate graph paper, of the velocity profiles at A-A and B-B. Use units of fpm (velocity) vs. inches (distance y). The plot should show the velocity over the entire open vertical distance at each station – 7 inches at A-A and 3.5 inches at B-B.

3) Calculation of the volumetric flow rate, Q, in cubic feet per second (cfs) at each station.

4) Comparison of the Q values calculated in step (3) at A-A and B-B. Give a brief, quantitative, physically-based discussion for any difference in Q at A-A and B-B.

Lab 1 Grading

Report Section	Points Possible
Title Sheet and Table of Contents	required
Lab Data Sheet	required
Introduction describing experiment	2
Plot of velocity profiles in appropriate units:	
at AA	4
at BB	4
Descriptive title for plot	2
Calculation of Q (ft^3/s) at each station	4
Compare air flow at AA and BB	2
Brief discussion of results	2