Detailed measurement on a HESCO diffuser

Rasmus L. Jensen¹, Dorte Holm² and Peter V. Nielsen¹

¹ Aalborg University, Department of Civil Engineering
² Herning Kommune, Teknik og Miljø
Annex 20

- A lot of measurements exist
- A lot of CFD simulation has been made
- The inlet velocity of the diffuser is uncertain!
$a_0 = \frac{1}{114.7 + 15.99 \cdot n^{-1}}$
Detailed measurement on a HESCO diffuser

Rasmus L. Jensen\(^1\), Dorte Holm\(^2\) and Peter V. Nielsen\(^1\)
\(^1\)Aalborg University, Denmark
\(^2\)Aarsnaes Kommune, Teknik og Miljø, Denmark

**SUMMARY**
This paper focuses on measuring the inlet velocity from a HESCO diffuser used in the IEA Annex 20 work as a function of the volume flow it provides. The aim of the present work is to establish a relation between the inlet velocity, the effective area and the airflow. This is important because the inlet velocity is a significant boundary condition in CFD calculations as well as general flow measurements. If only the volume flow and the geometrical area are used, a relatively large error in the inlet velocity may result. From the detailed measurements it was possible to establish an expression between the inlet velocity and the effective area.

**RESULTS**
- Mean inlet velocity as a function of air change rate
- Effective inlet area as a function of air change rate

**CONCLUSIONS**
When determining the effective inlet area, it is important to verify that the assumption regarding the velocity profile across the nozzles holds. Also, one should be careful to measure only at a limited number of points since there can be large variations between the different nozzles.

Based on the measurements, an expression for the effective inlet area given as a function of the air change rate is derived. The agreement between the expression and the measurements is excellent and, therefore, the expression should be used when determining boundary conditions for CFD simulations based on the Annex 20 room geometry.

**EXPERIMENTAL SET-UP**
- Full-scale test rooms
- Laser Doppler Anemometer

**Velocity profile across a nozzle**
A square velocity profile is assumed. The figure shows that to be a fair assumption.

**Inlet velocity**

\( \text{Inlet velocity} \)

\( \text{Effective inlet area as a function of air change rate} \)

\( A_e = \frac{144}{Q} + 15.5 \text{ m}^2 \)

\( Q = 0, 0672 \text{ m}^3/\text{s} \Rightarrow A_e \to \infty \)

**Comparison with previous results**