

Mitigation Strategies for Airborne Transmission in High-Rise Drainage Pipes

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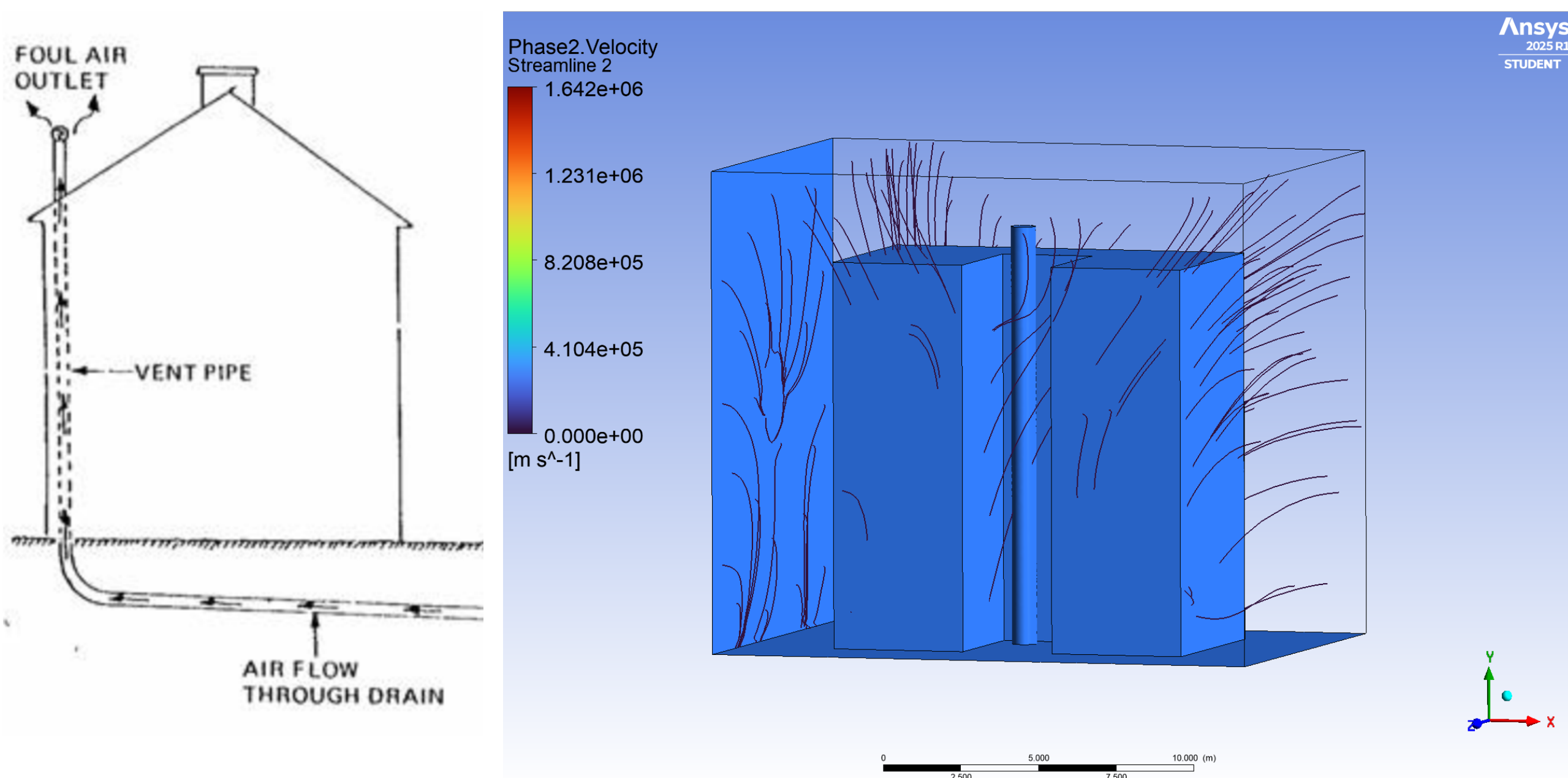
Introduction

Problem

- Pathogens (e.g., COVID-19) spread via aerosols in drainage pipes, contaminating upper floors.
- Outbreak in Heng Tai House (2020) linked to rooftop vent backflow.

Research objective

- Investigate how ventilation pipe length and design reduce aerosol re-entry using CFD

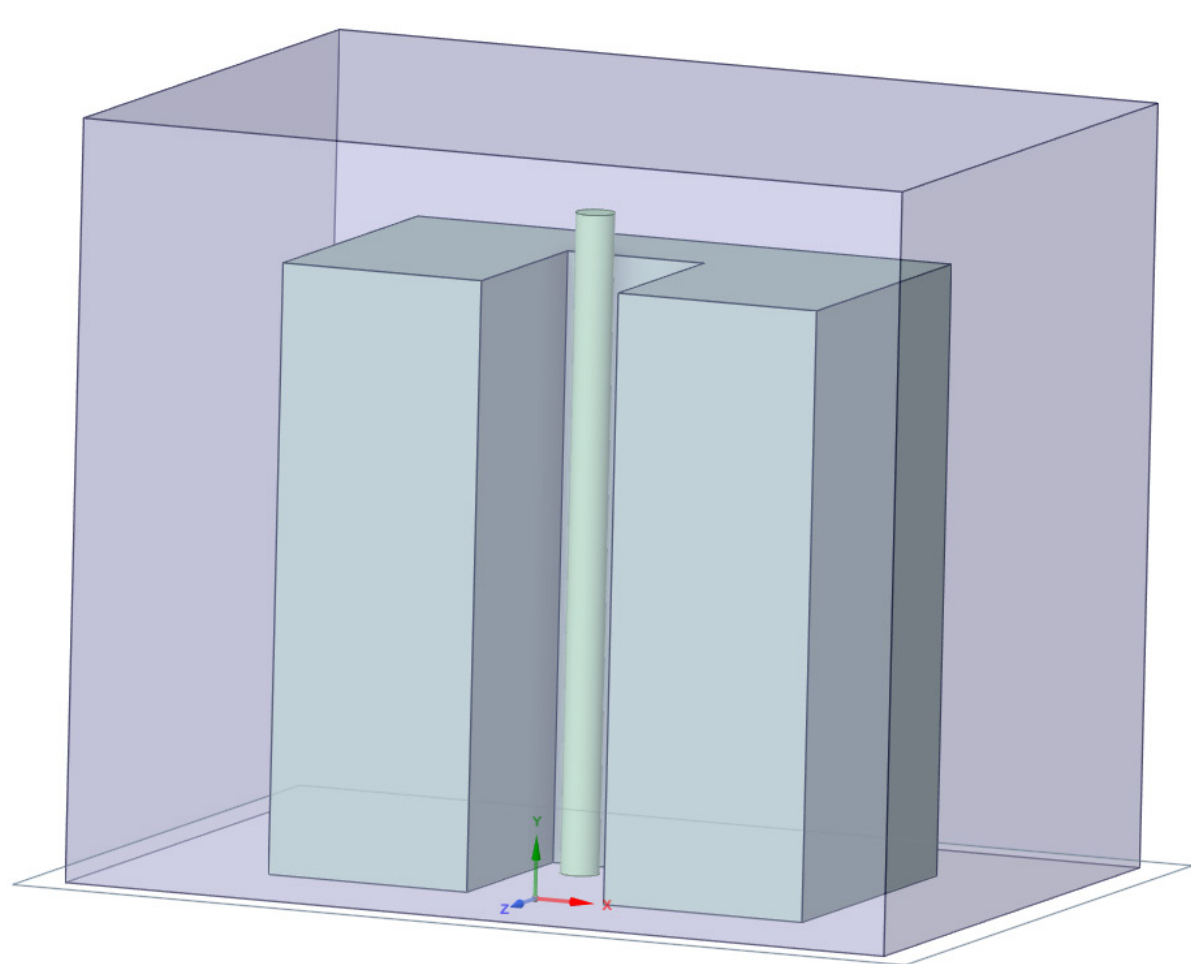


CFD Simulation (Ansys Fluent)

- Model: 5 floors (28–32) of Heng Tai House, 80mm pipes.

Cases:

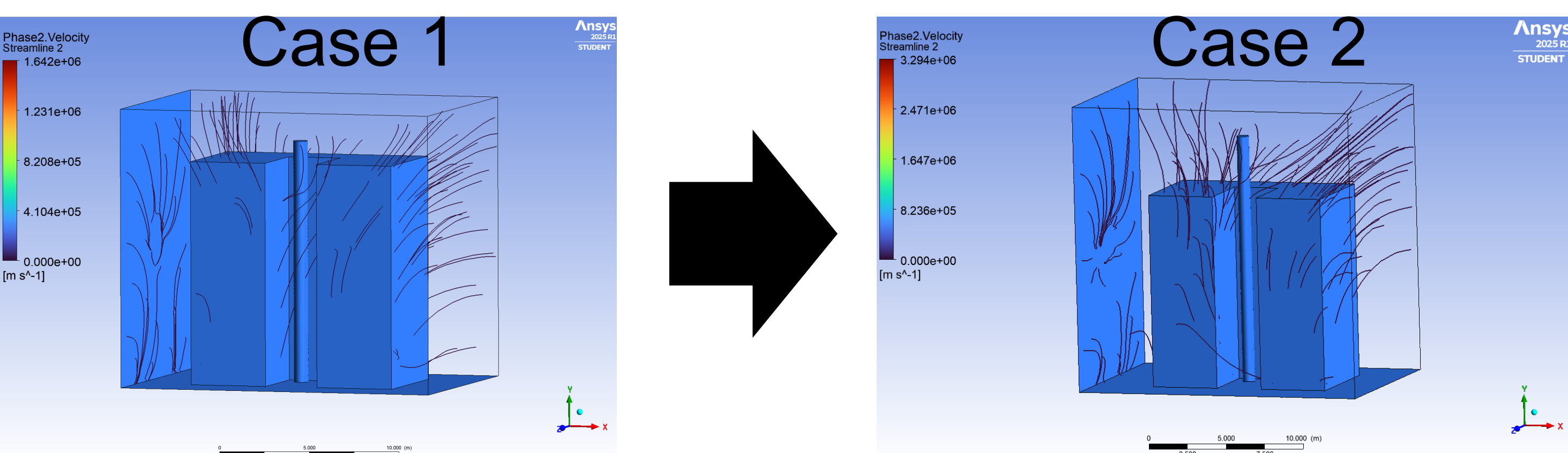
- Case 1: 1.5m pipe (summer winds).
- Case 2: 2.5m pipe (summer).
- Case 3: 2.5m pipe (winter).
- Data: Hong Kong Observatory wind speeds



Key Results

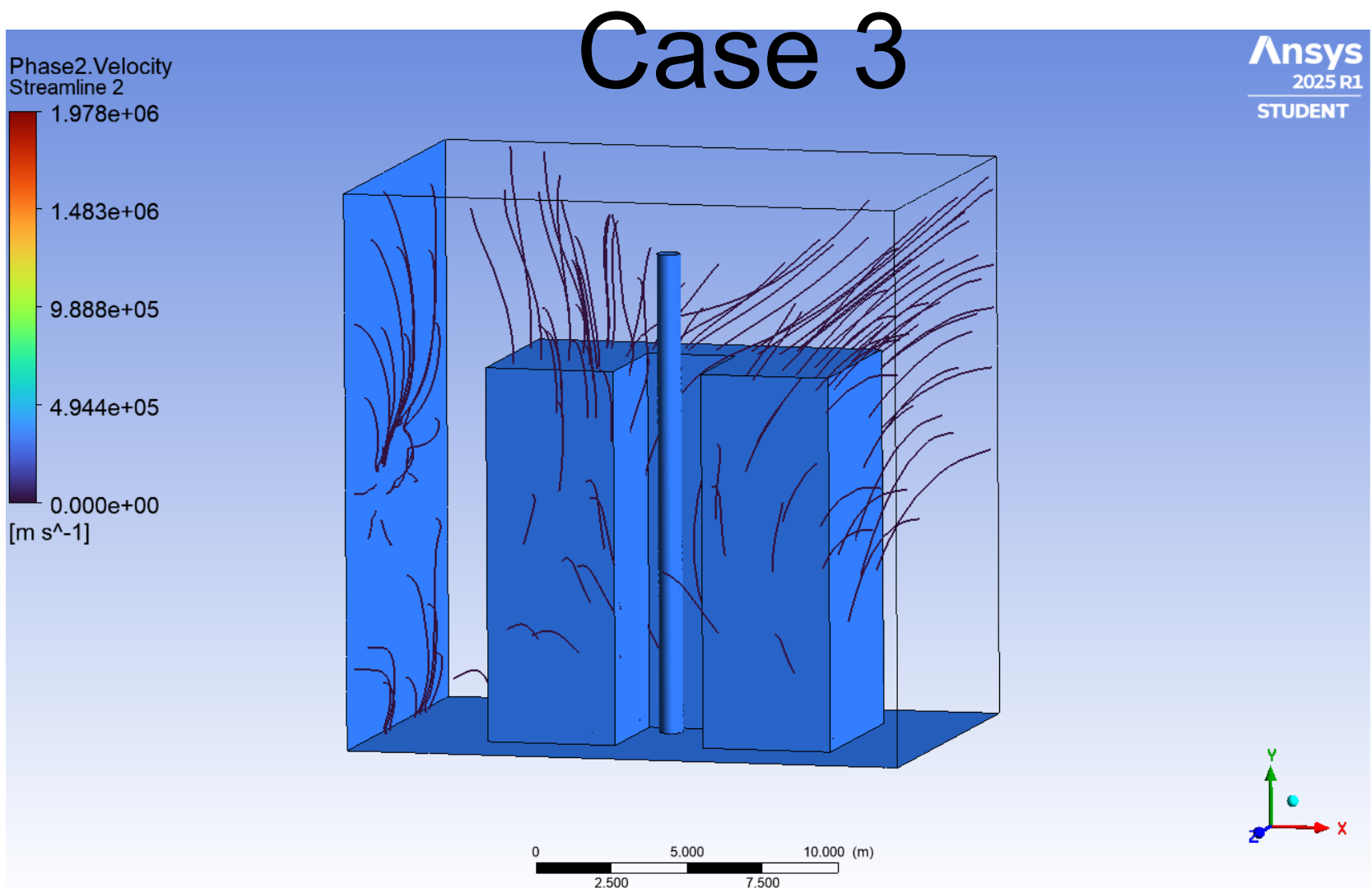
Finding 1: Longer pipes reduce backflow.

- Case 1: Shorter pipe → aerosols recirculate to windows.
- Case 2: Streamlines show aerosols dispersing away from building



Finding 2: Winter winds enhance dispersion.

- Case 3: Strong winds push aerosols horizontally.



Design Recommendations

- ✓ Extend vent pipes $\geq 2.5\text{m}$ above rooftops.
- ✓ Increase pipe diameter ($>80\text{mm}$) to stabilize airflow.
- ✓ Account for seasonal winds in building codes.

Policy Impact:

- Retrofit old buildings;
- update codes for new
- high-rises.



Longer vents + larger diameters
= cost-effective solution to curb
airborne transmission.



Future Work

Transient simulations for dynamic water flows.

