Car Park Ventilation Systems

Introduction to system solutions

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Woods Air Movement Fan Academy 2022

Car park structures & requirements

Car park ventilation solutions

Reduce ***Carbon Monoxide (CO)***

Deal with ***Smoke*** in the event of a fire

Car park ventilation solutions

HM Government

The Building Regulations 2010

Volume 2: Buildings other than dwellings

Requirement F1: Means of ventilation

Regulations: 39 and 44

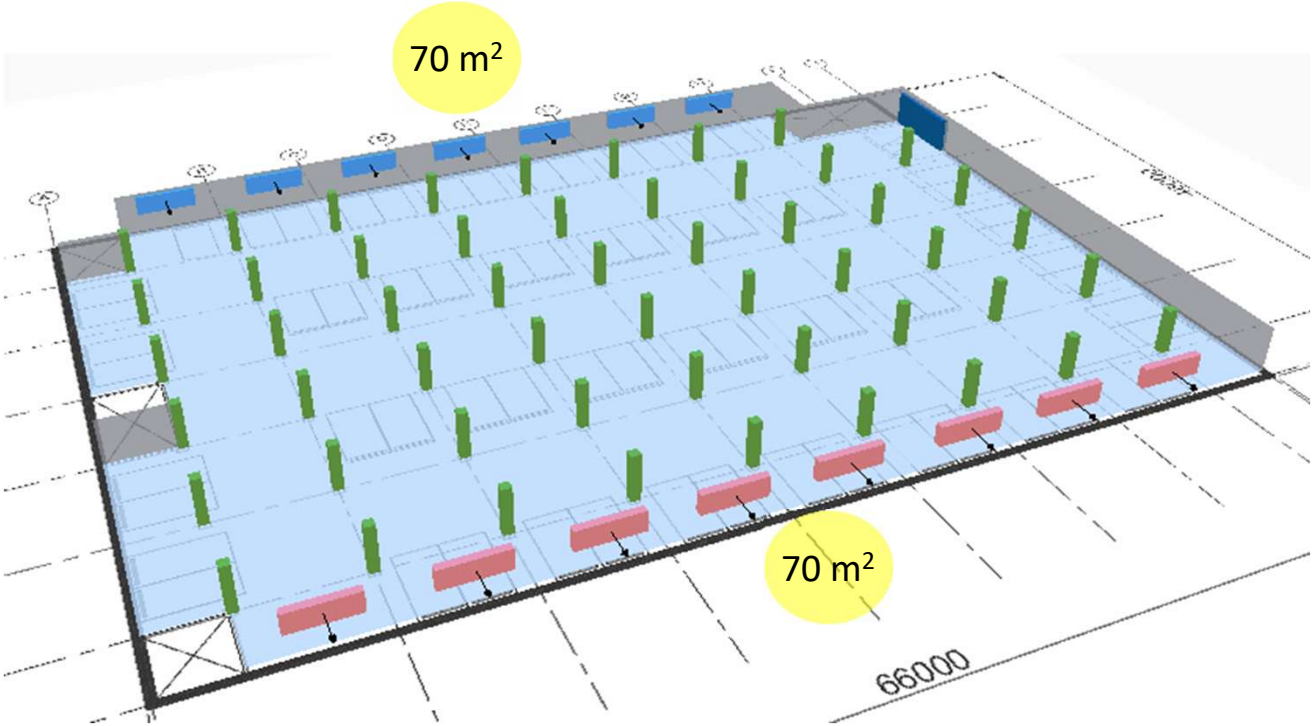
1. **Open sided car parks**
2. **Partially open sided car park**
3. **Enclosed car parks**

Open sided car parks

I. Minimum aggregate equivalent (natural vent.) area, ***1/20th*** of the level floor area.

II. Minimum of ***25%*** of the aggregate equivalent area ***on each of two opposing walls.***

Open sided car parks

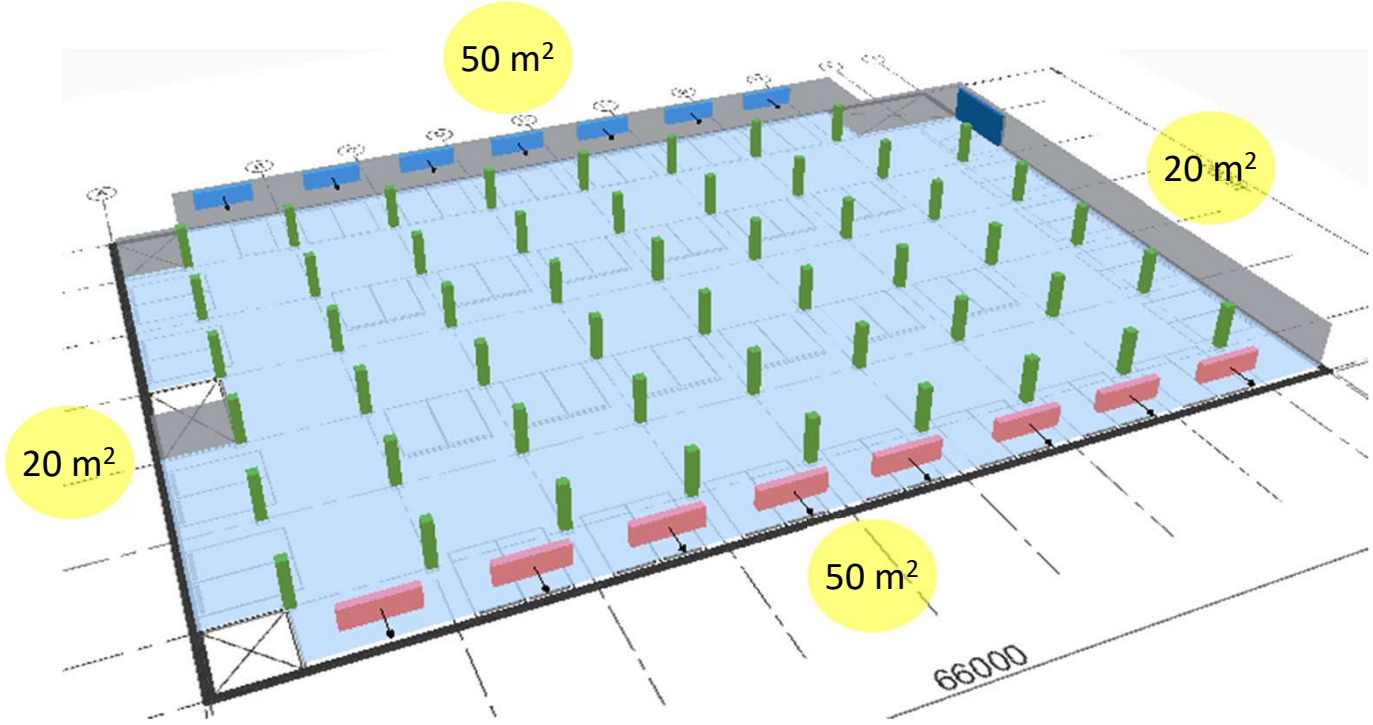


Floor area = 2,800 m²

1/20th = 140 m²

25% of 1/20th = 35 m²

Open sided car parks



Floor area = 2,800 m²

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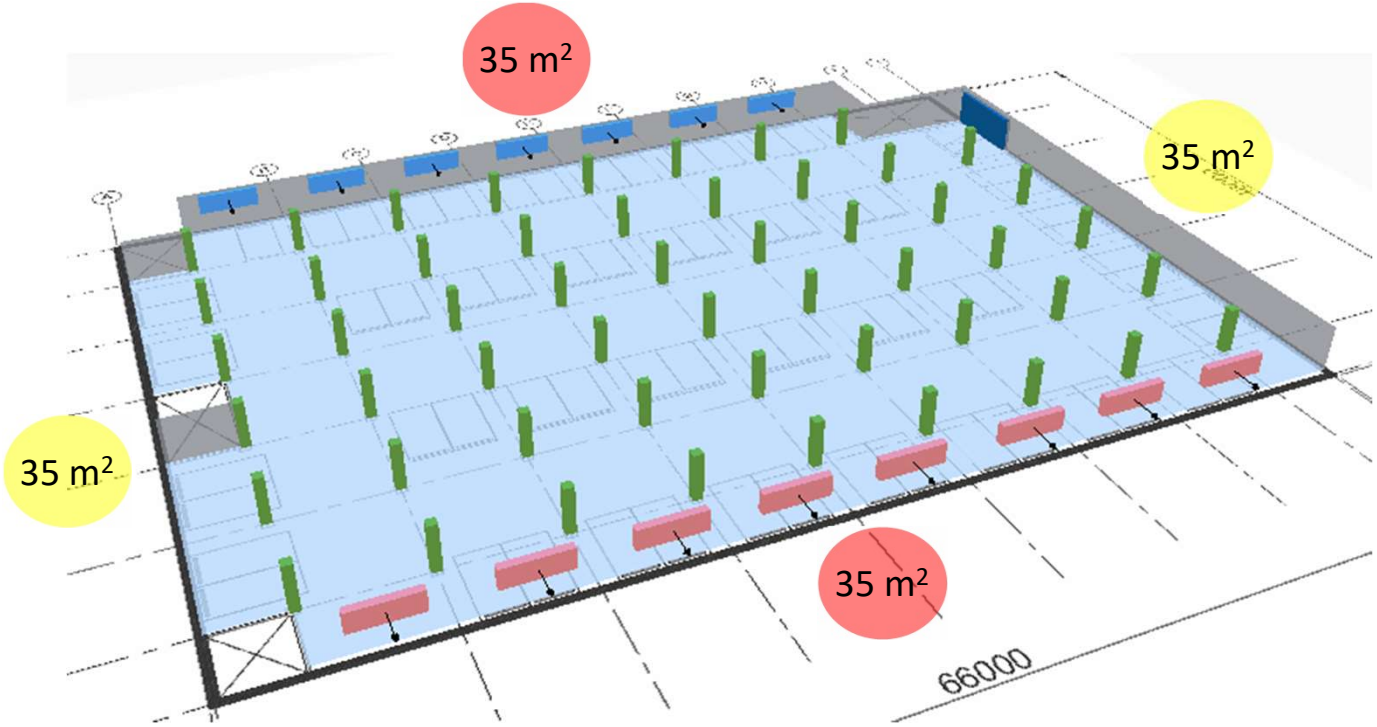
25% of 1/20th = 35 m²

20 m²

Open sided car parks



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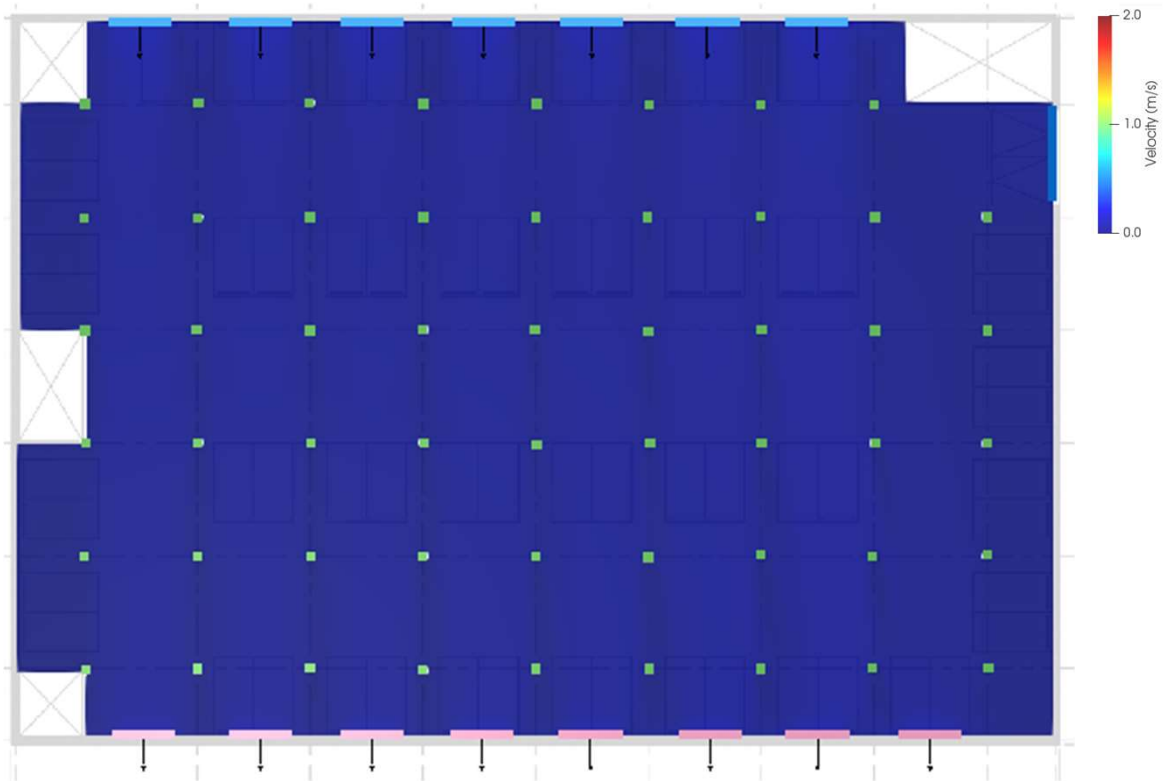
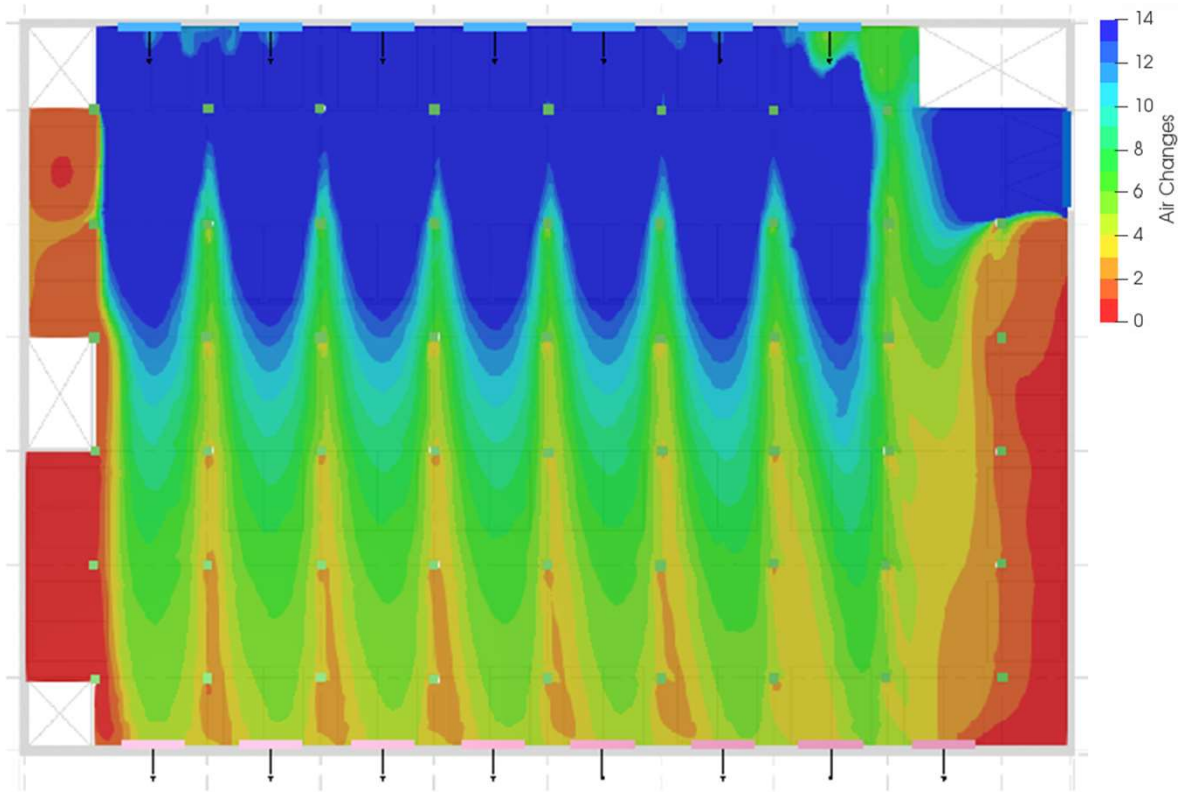


Open sided car parks

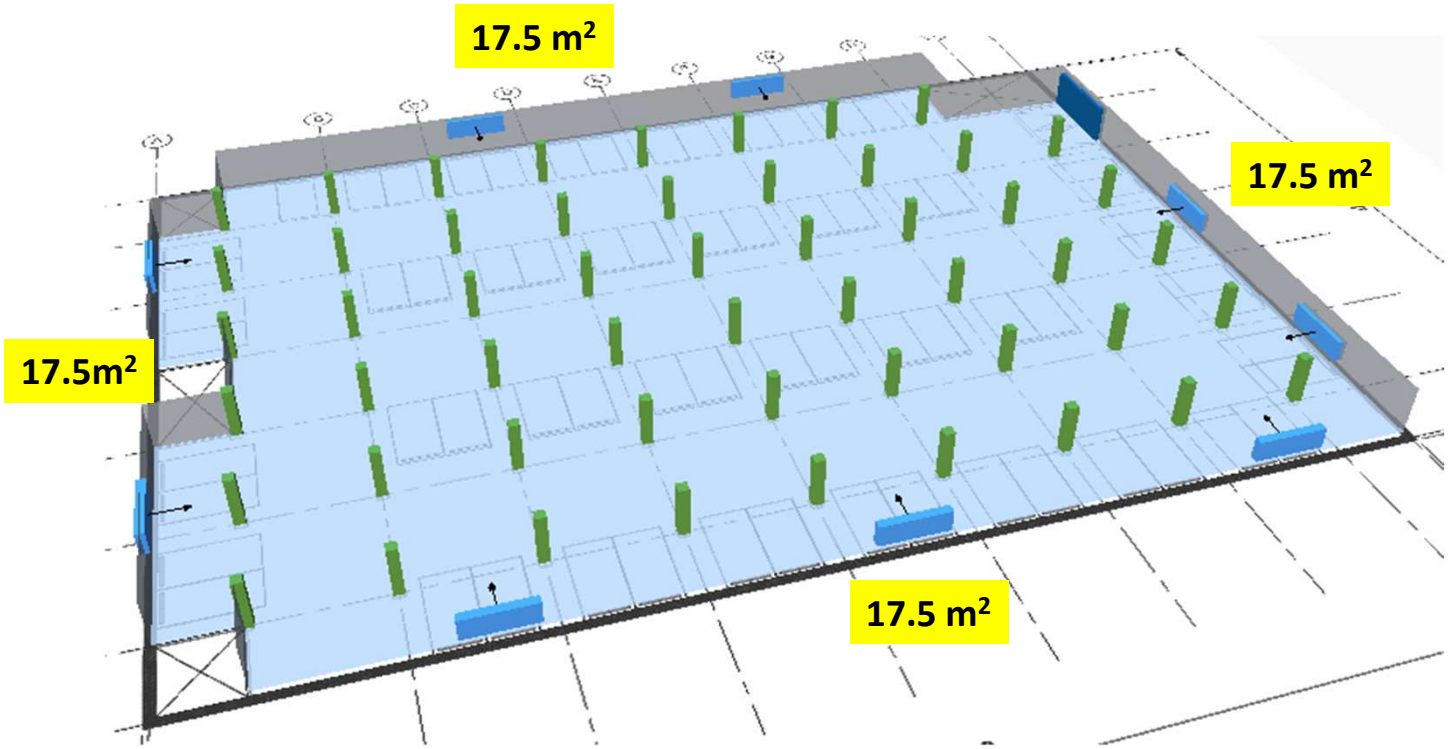


Partially open sided car parks

1. Minimum aggregate equivalent (natural vent.) area, ***1/40th*** of the level floor area.

2. ***Mechanical extract system*** capable of providing the equivalent of ***3 ACH***

Partially open sided car parks



Floor area = 2,800 m²

1/40th = 70 m²

Height = 3 m

Mech. extract = 7.0 m³/s

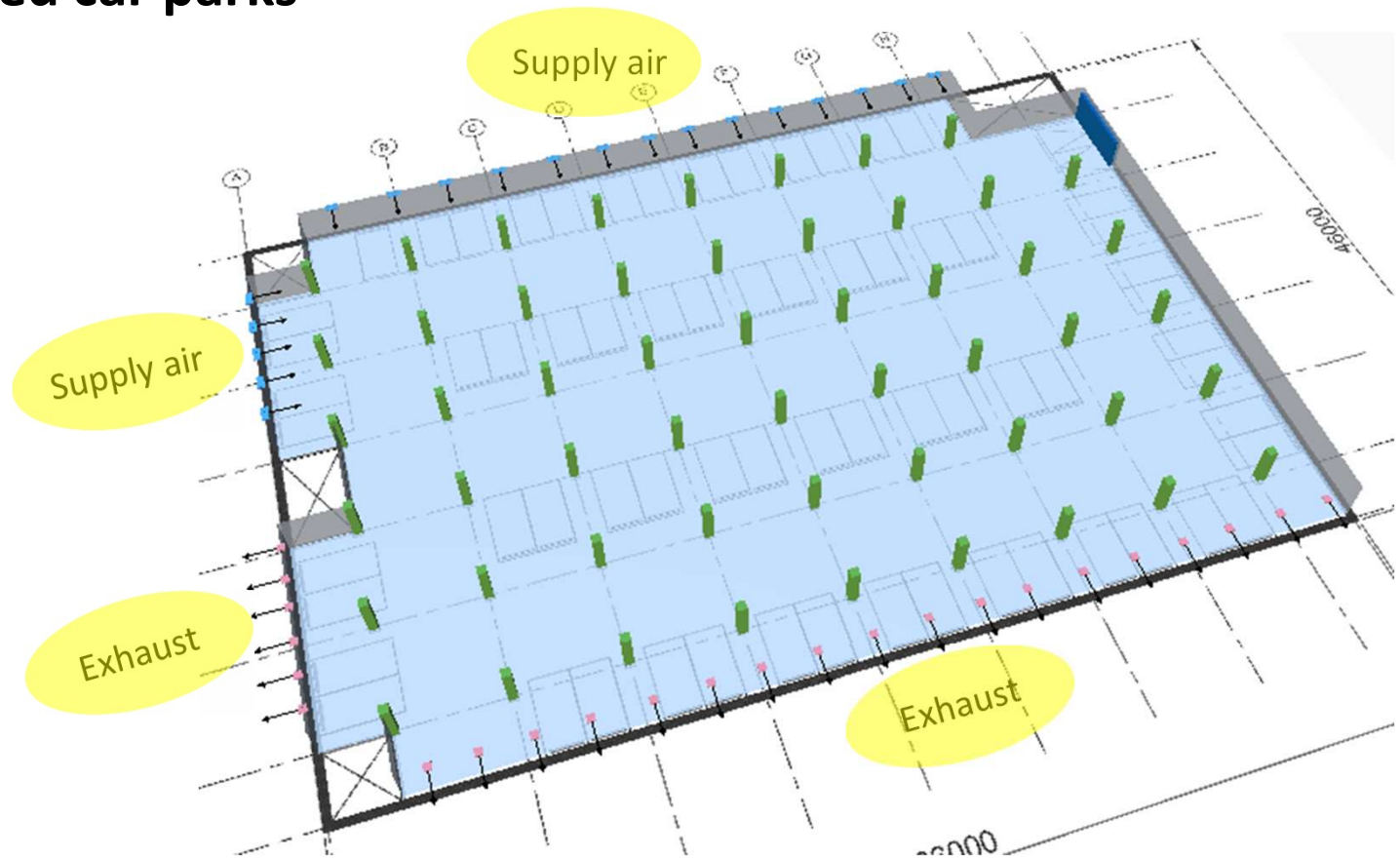
Enclosed car parks

I. Mechanical extract system to provide ***at least 6 ACH*** during ***day-to-day operation*** *(Approved Document F)*

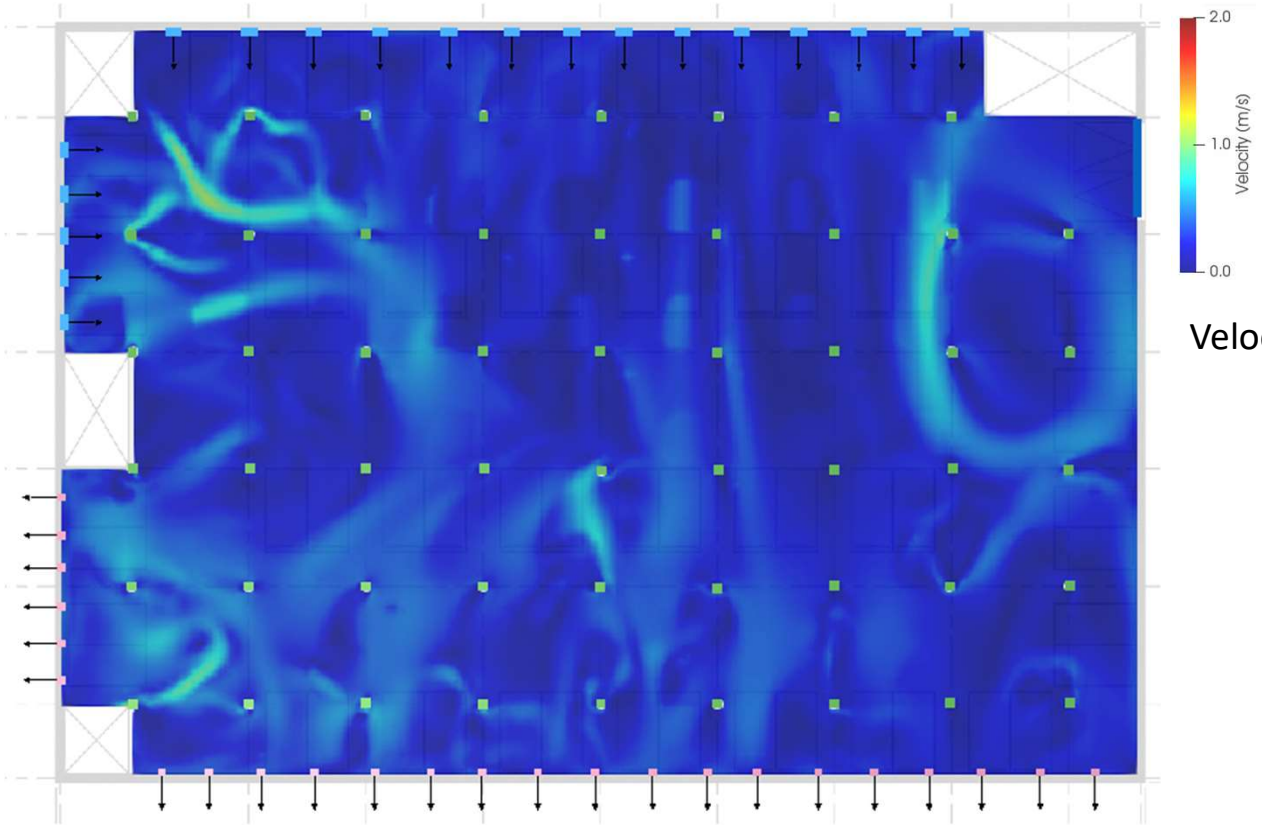
II. Mechanical extract system to provide ***at least 10 ACH*** to provide ***speedier smoke clearance*** during and after a fire has been extinguished

Enclosed car parks

Enclosed car parks

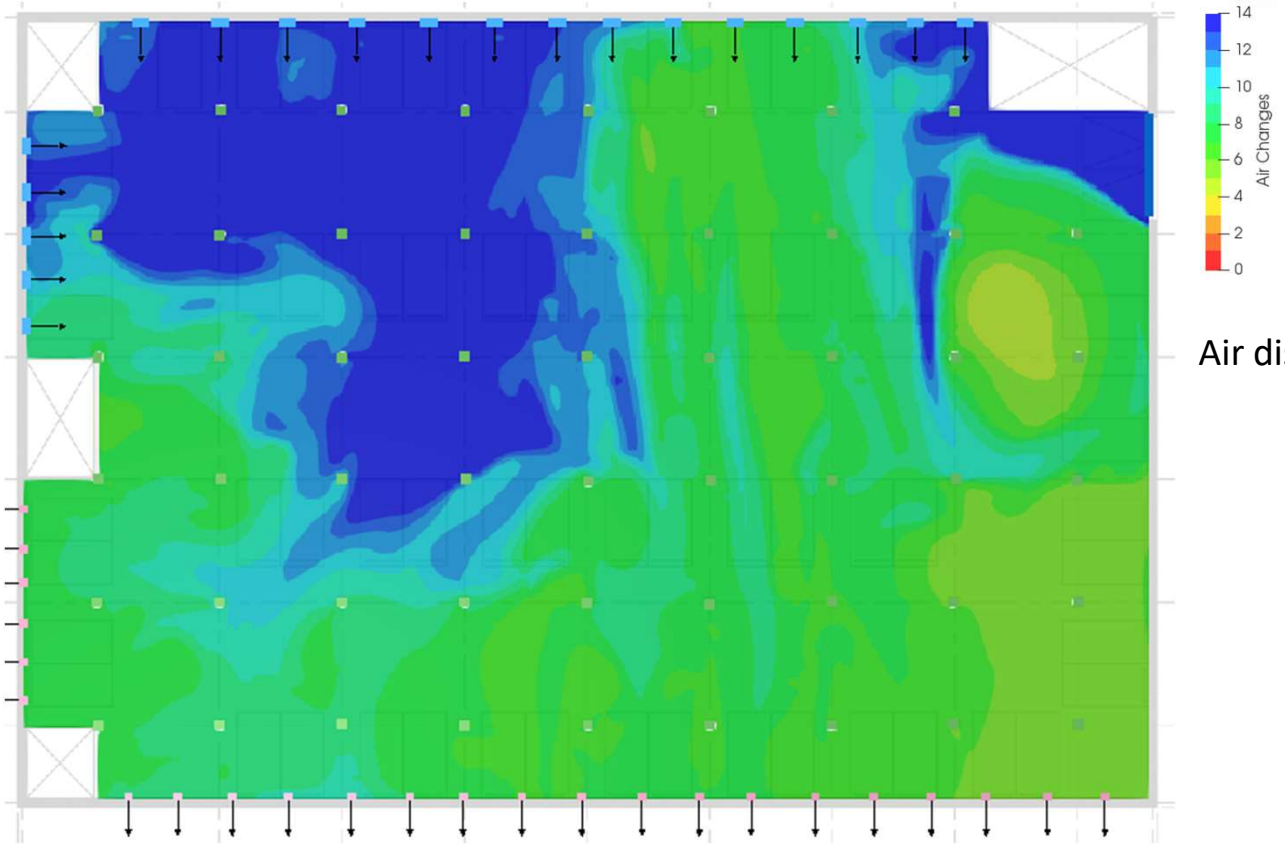


Enclosed car parks



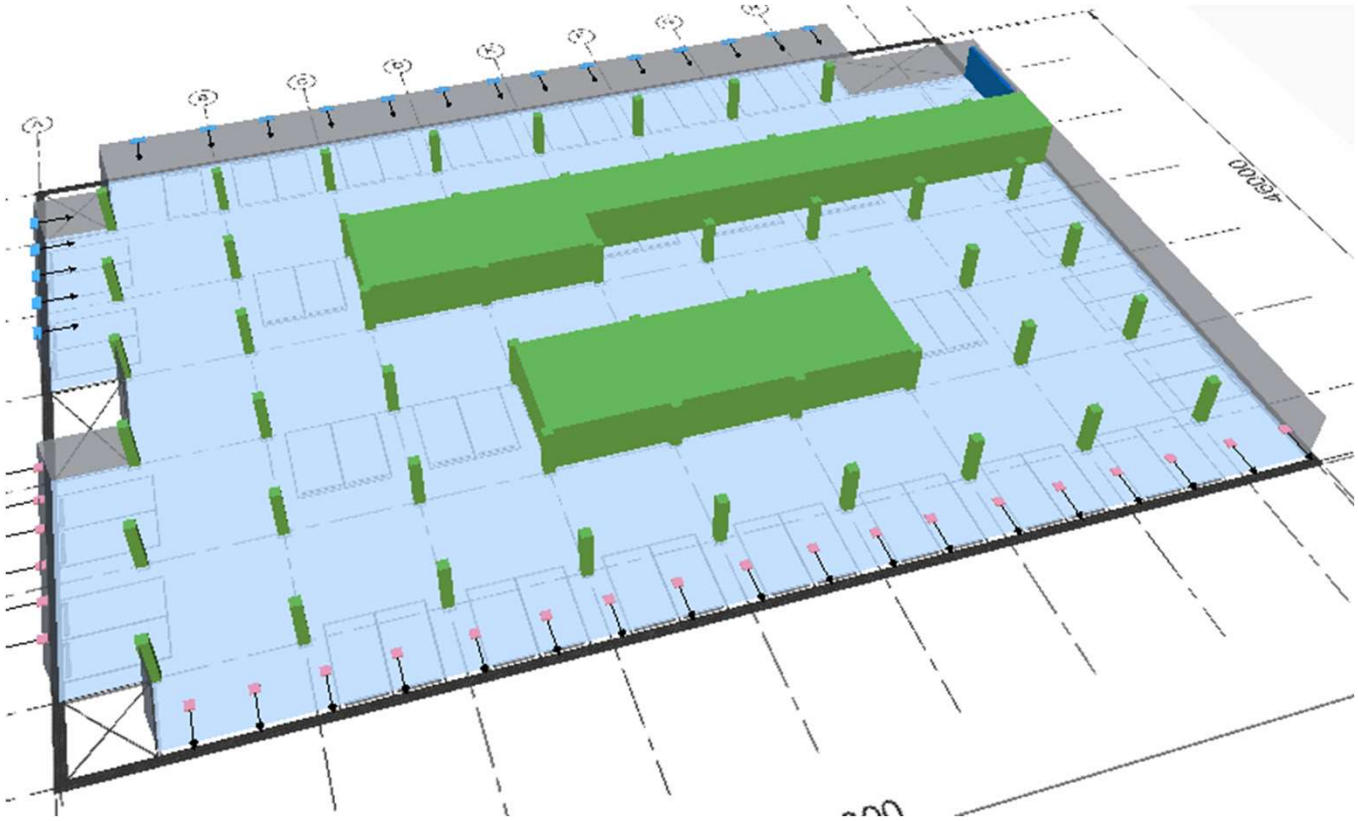
Velocity contours

Enclosed car parks



Air distribution contours

Enclosed car parks



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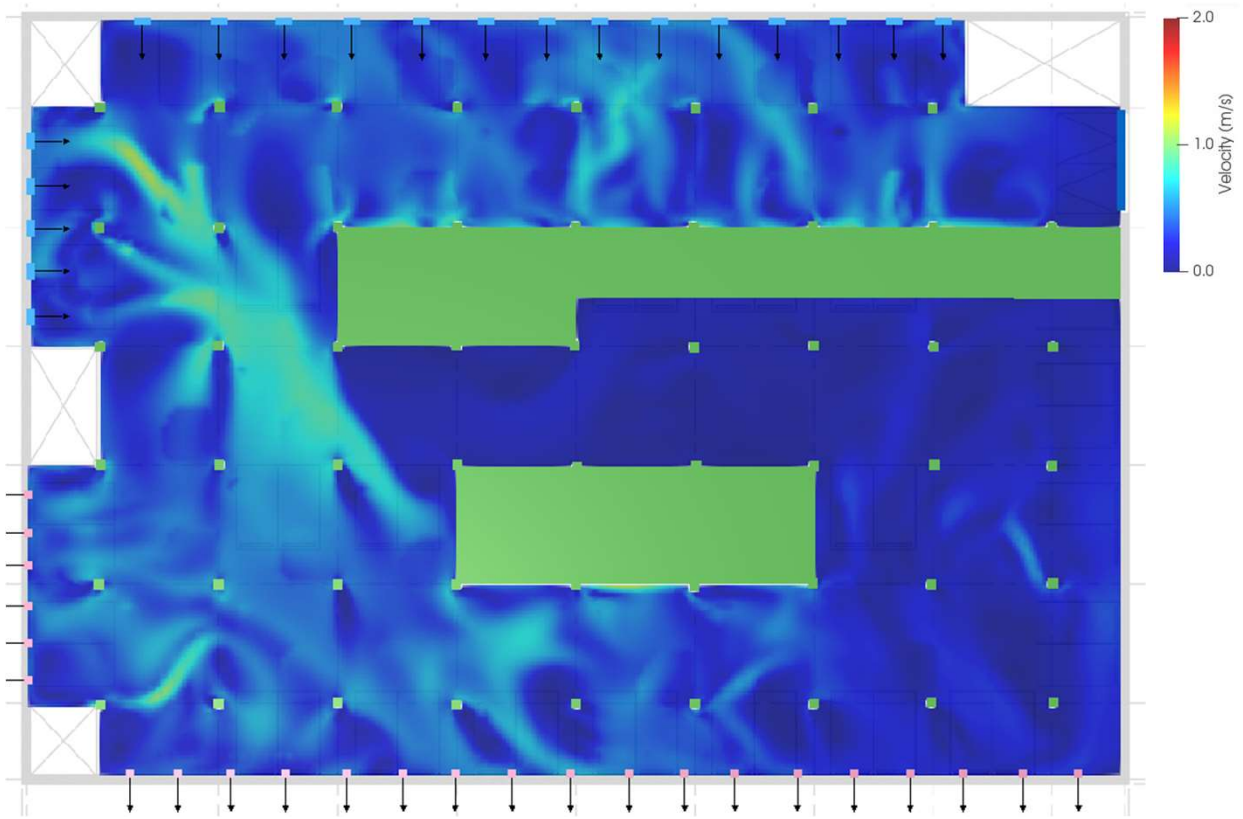

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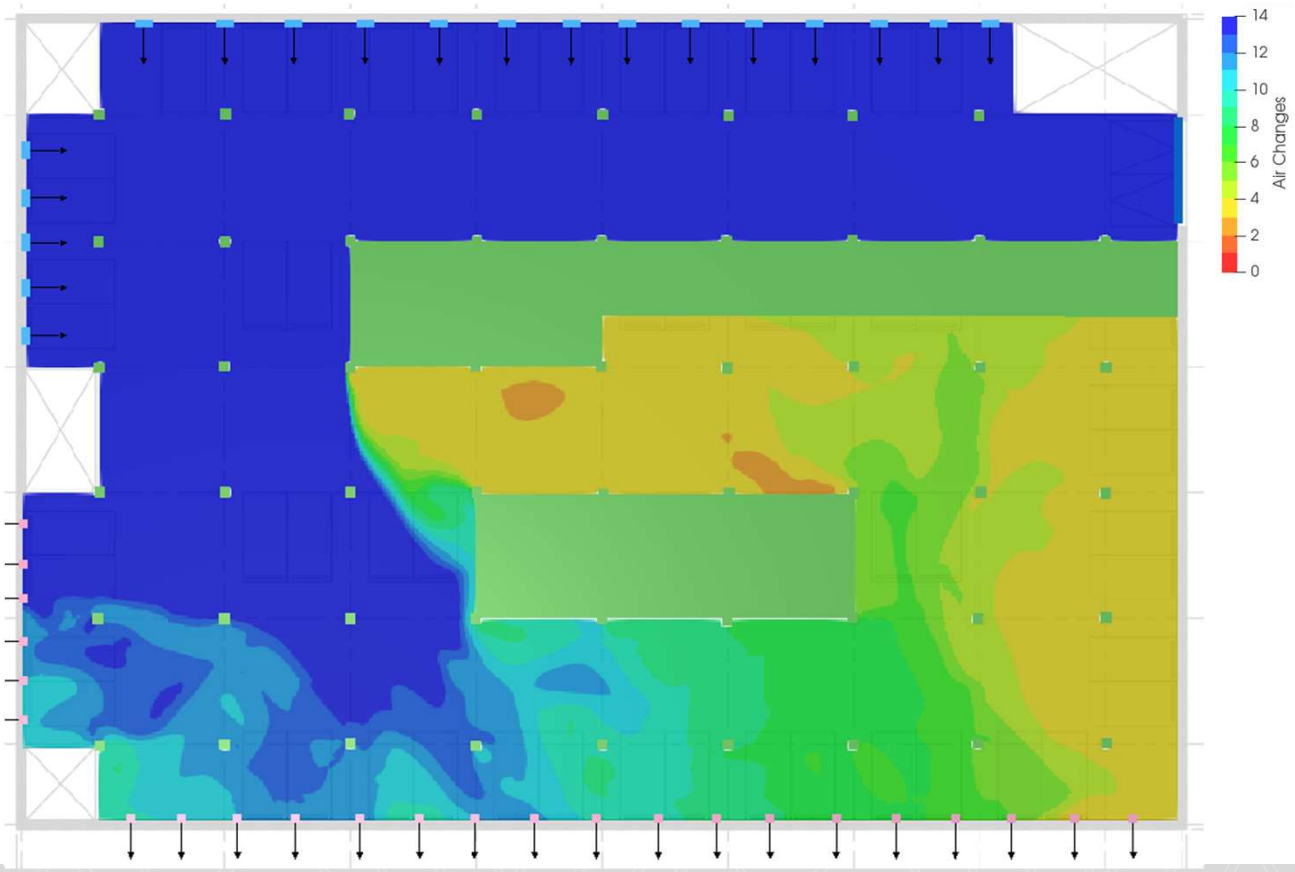

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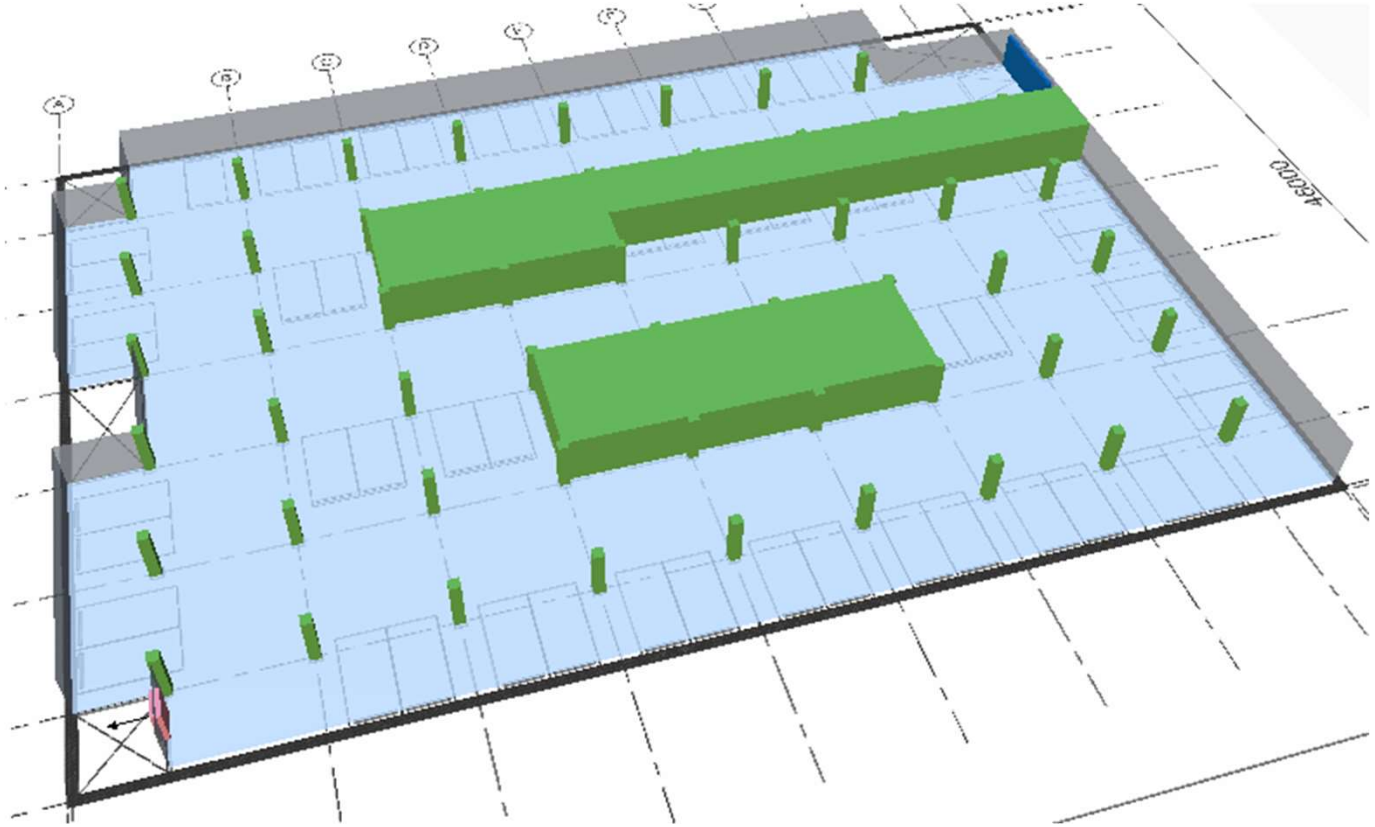

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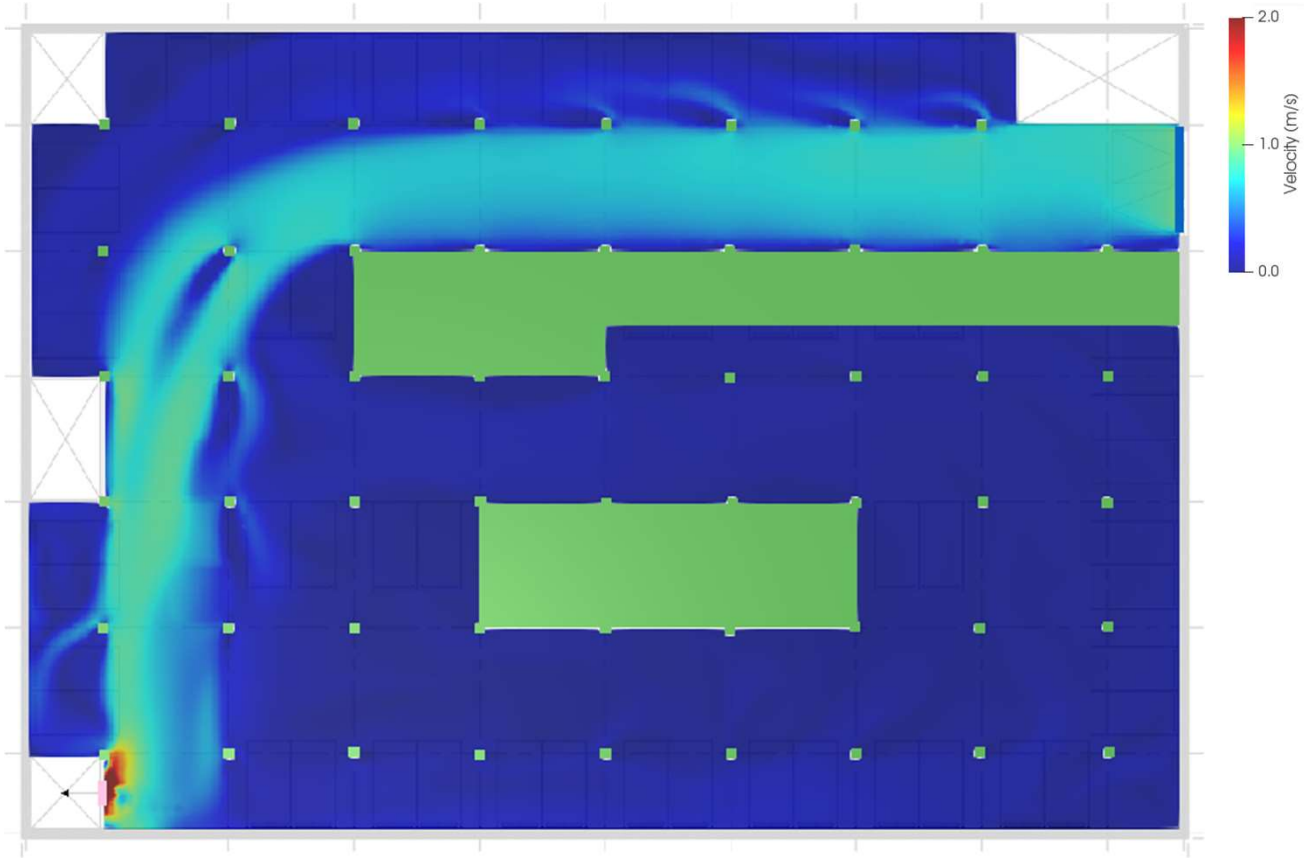

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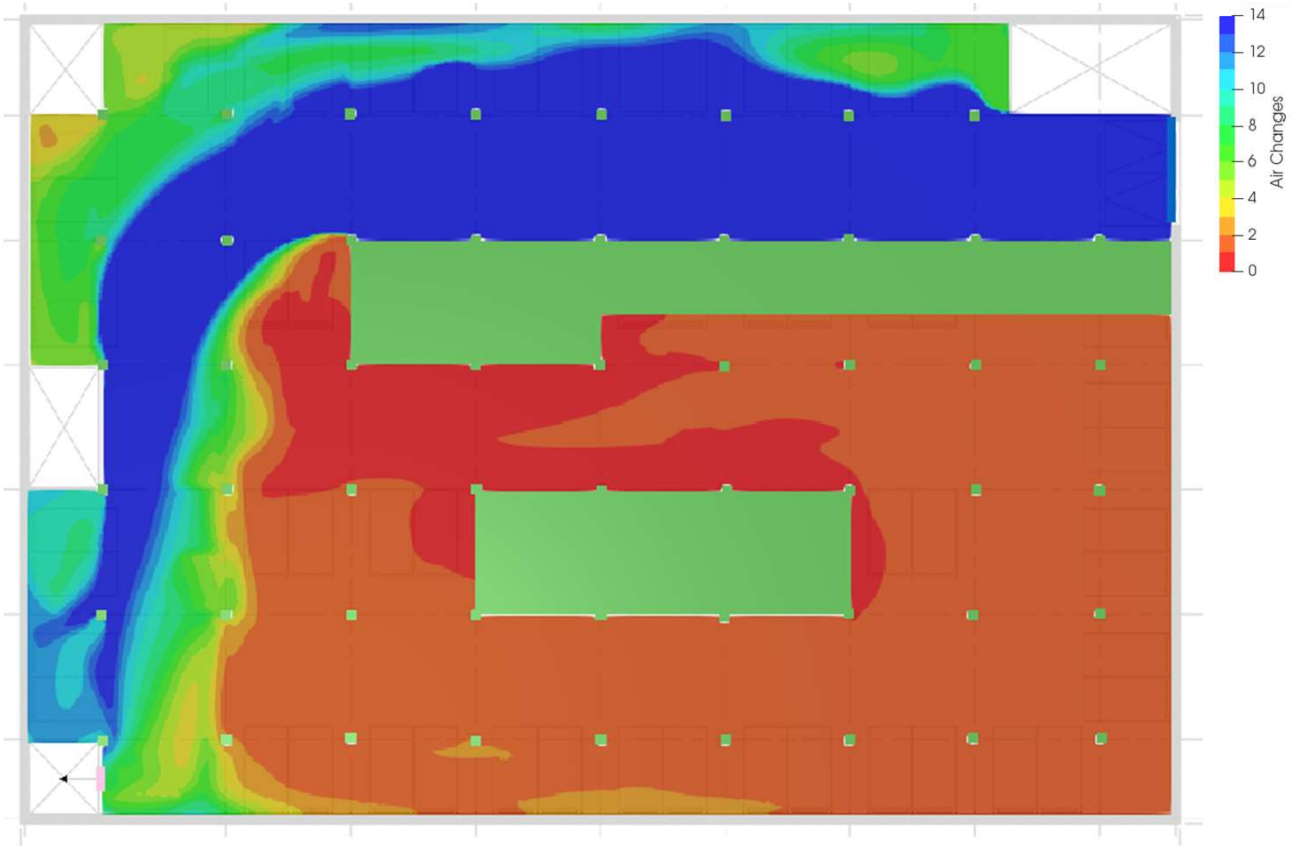

Jet Fan Technology

Jet Fan technology

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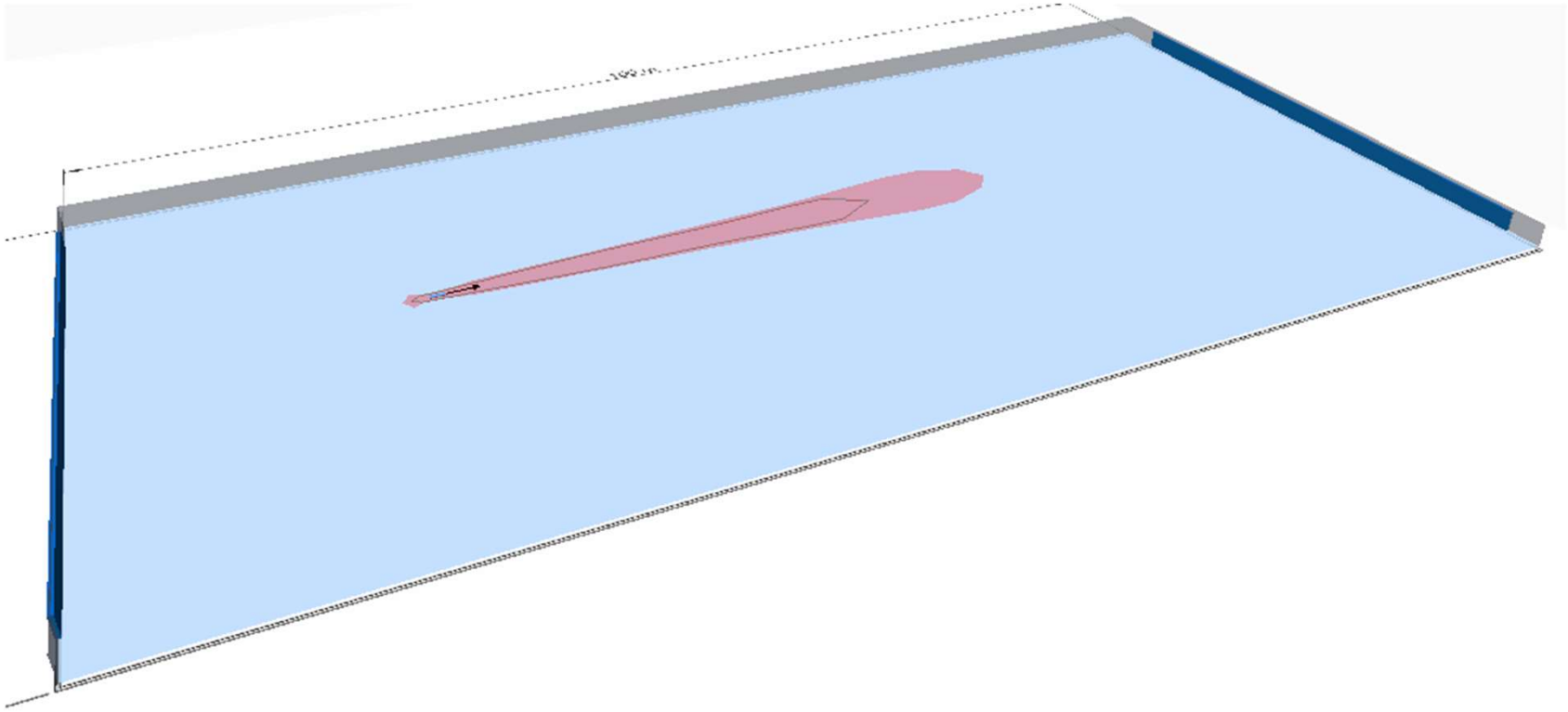

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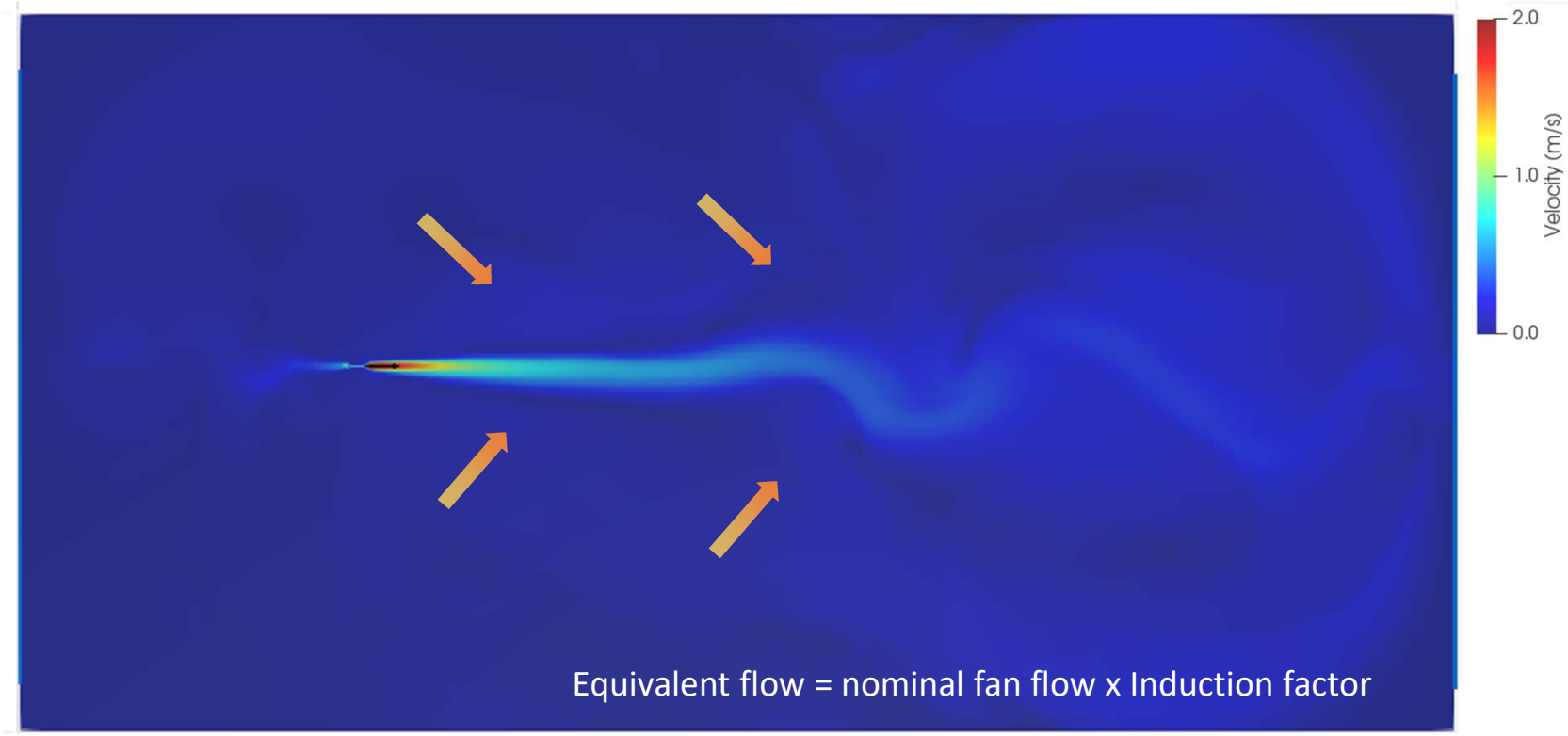

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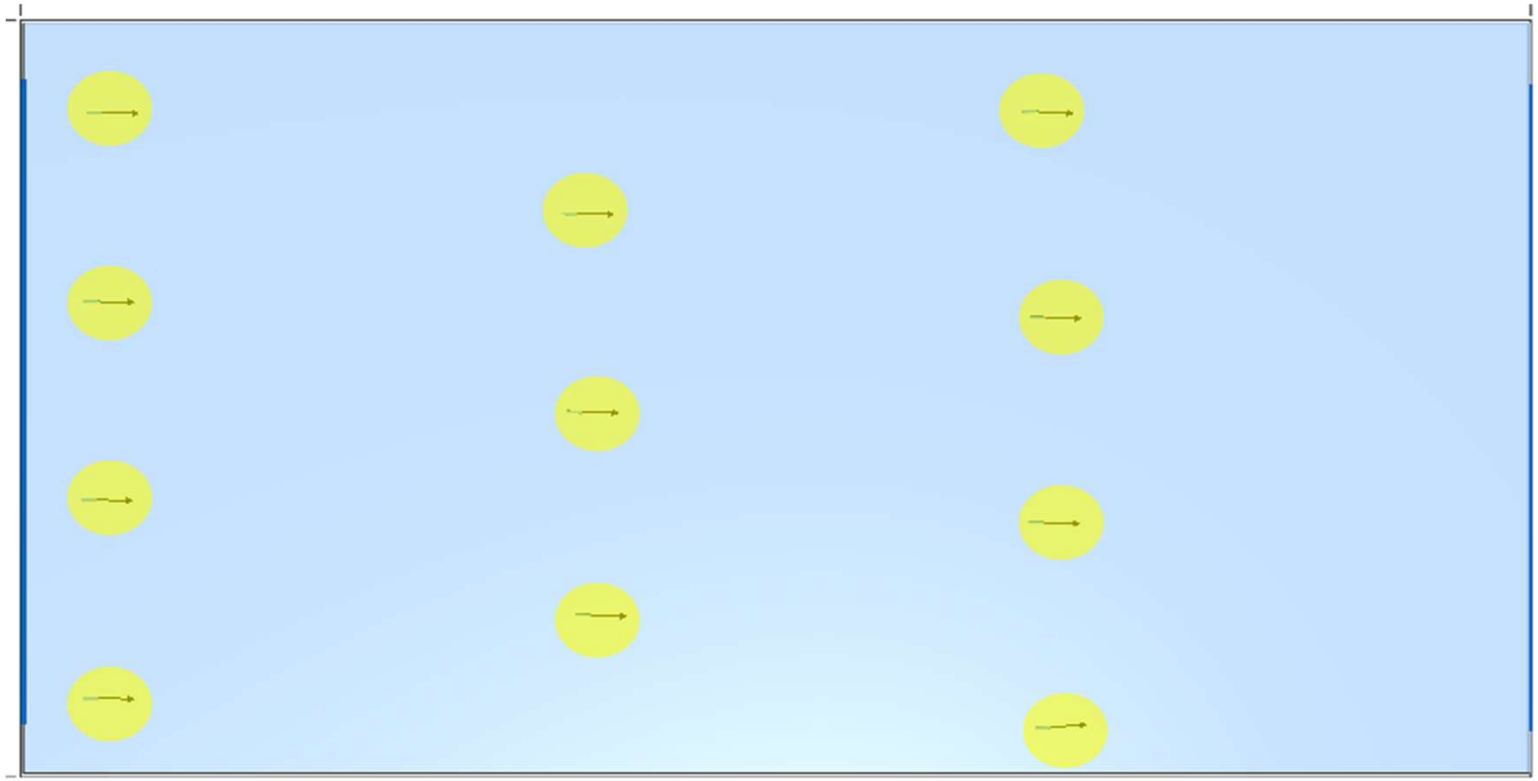

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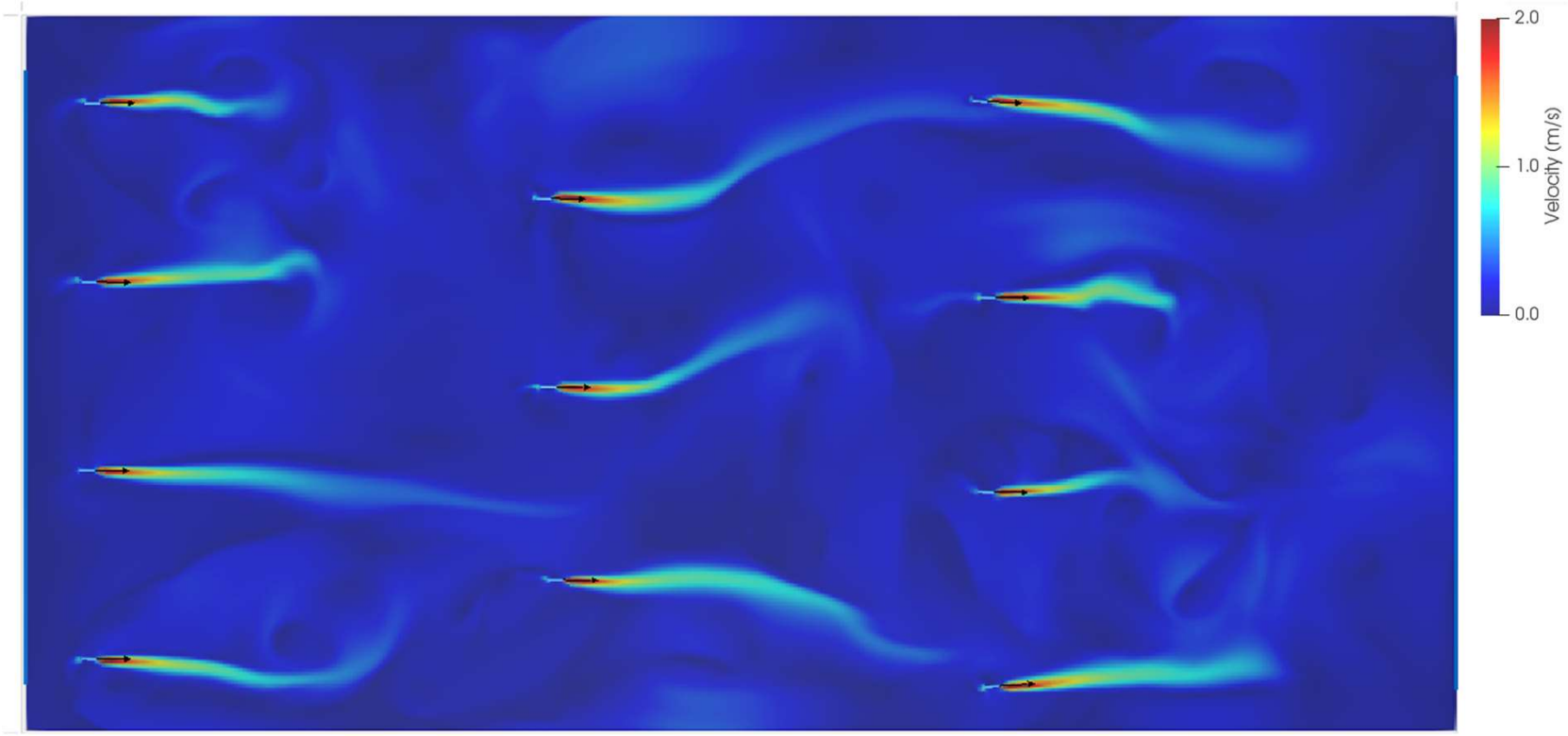

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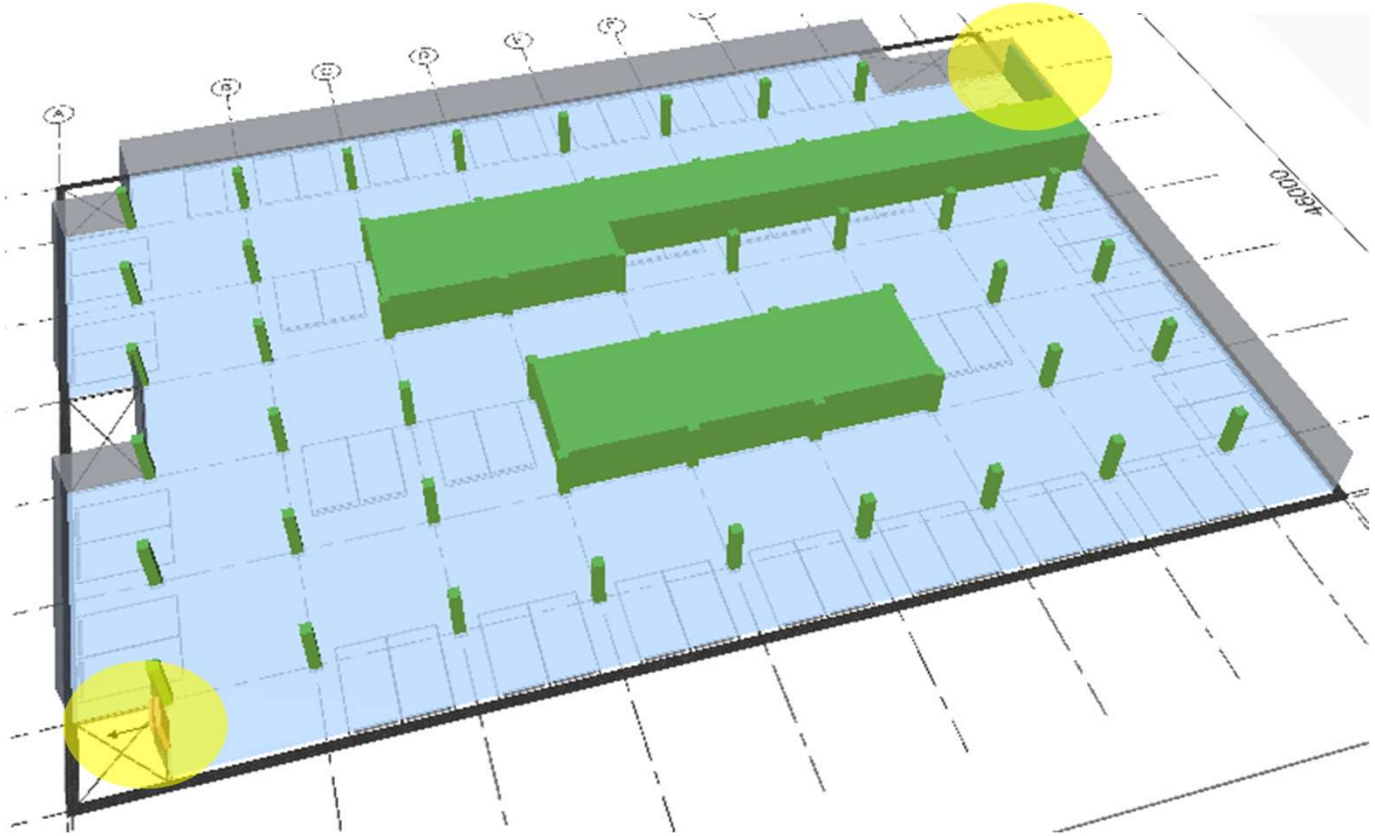

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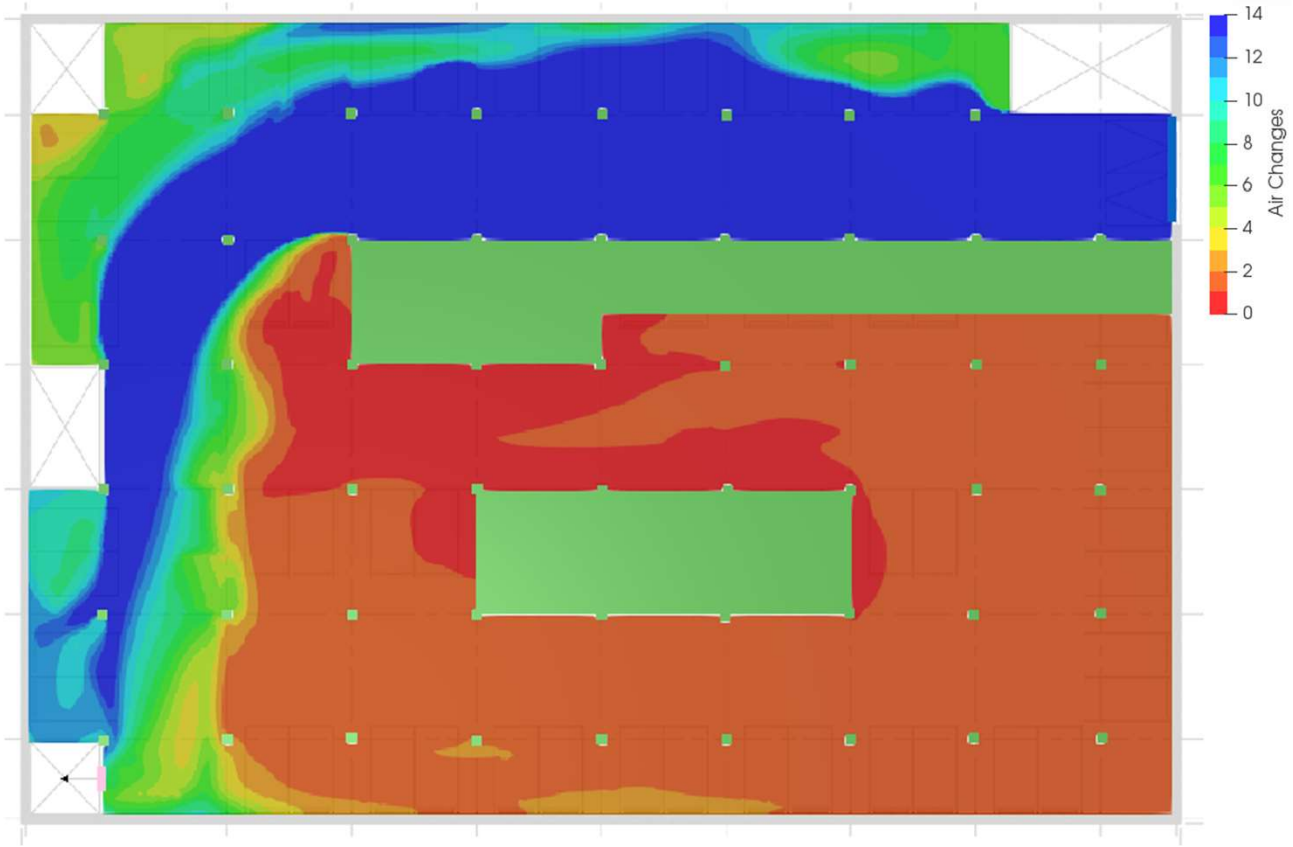

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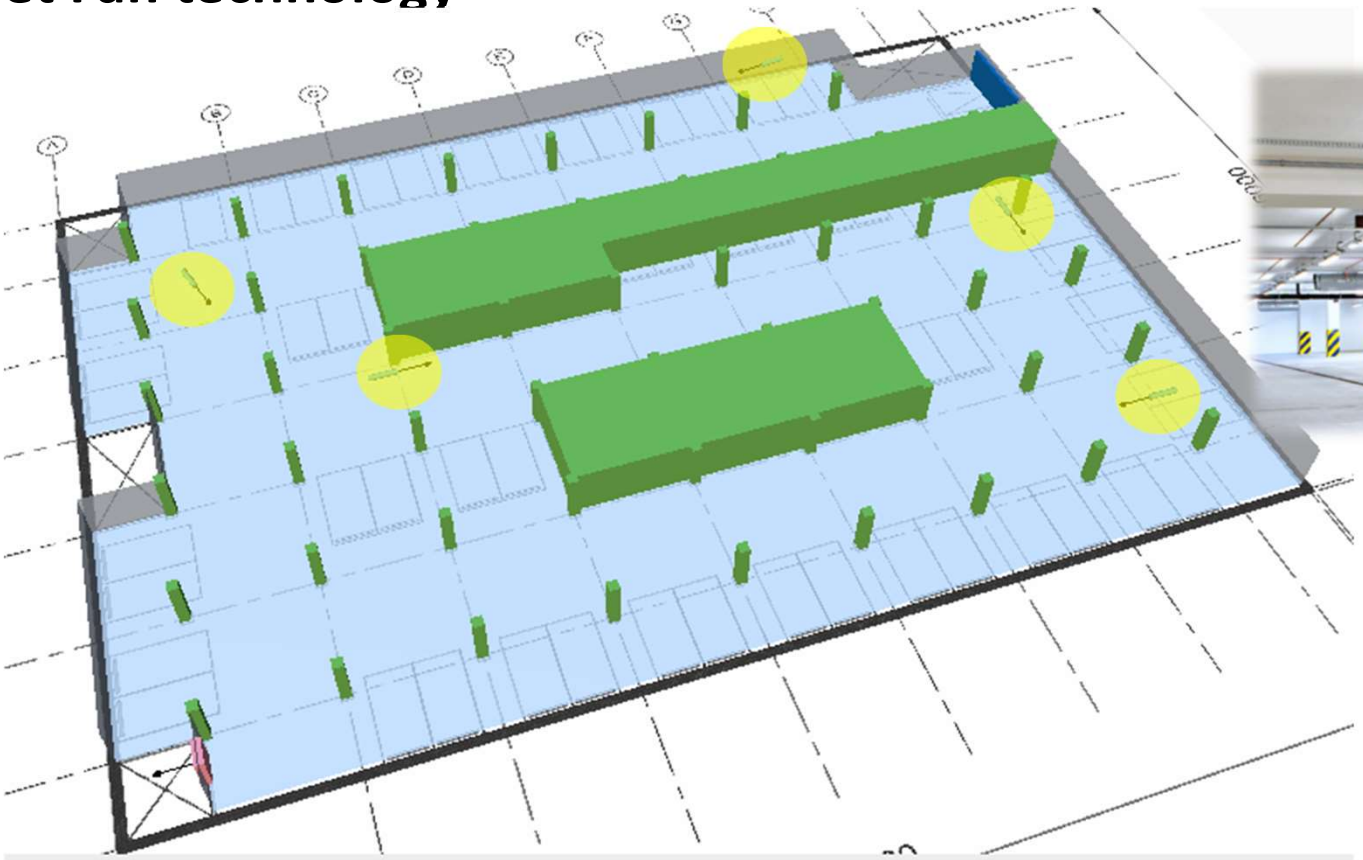

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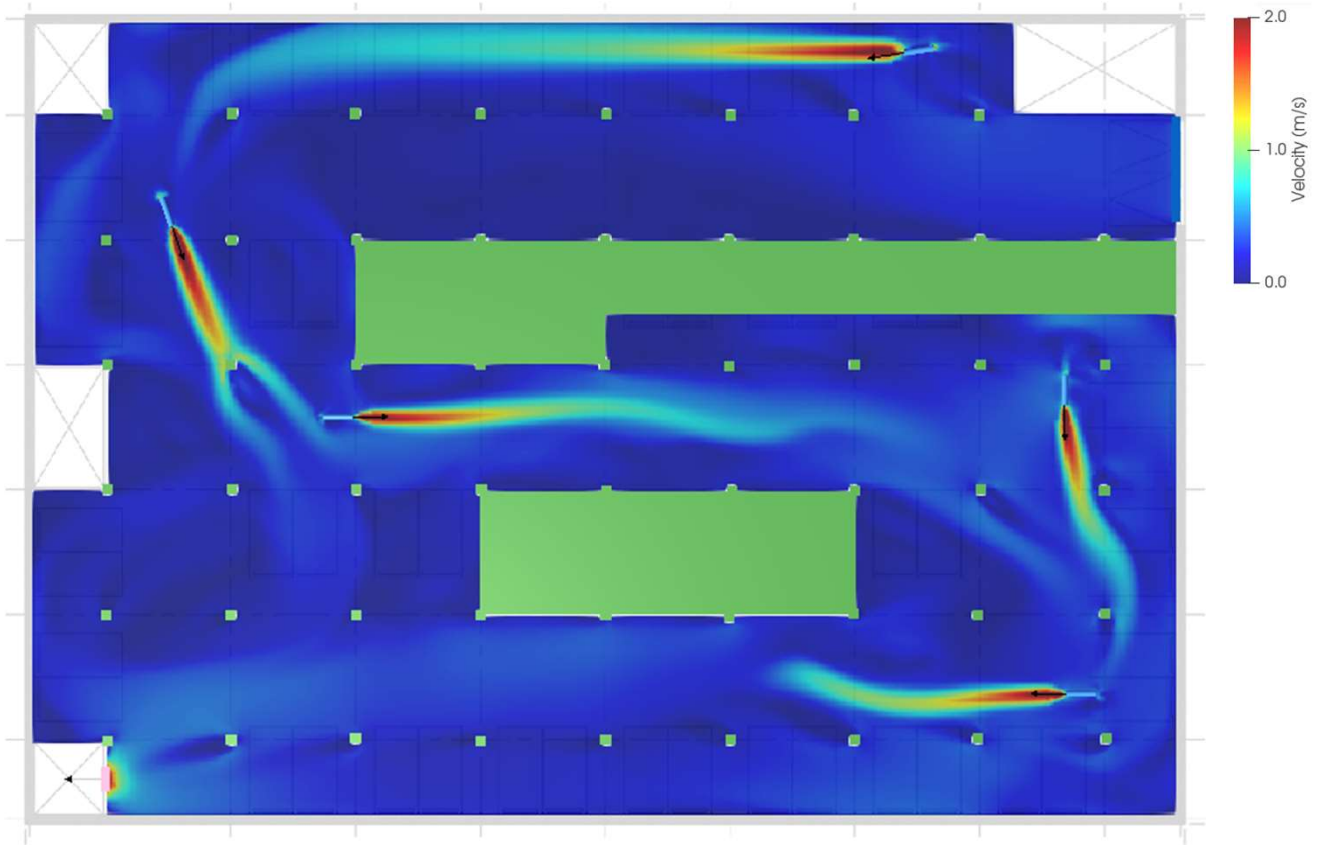

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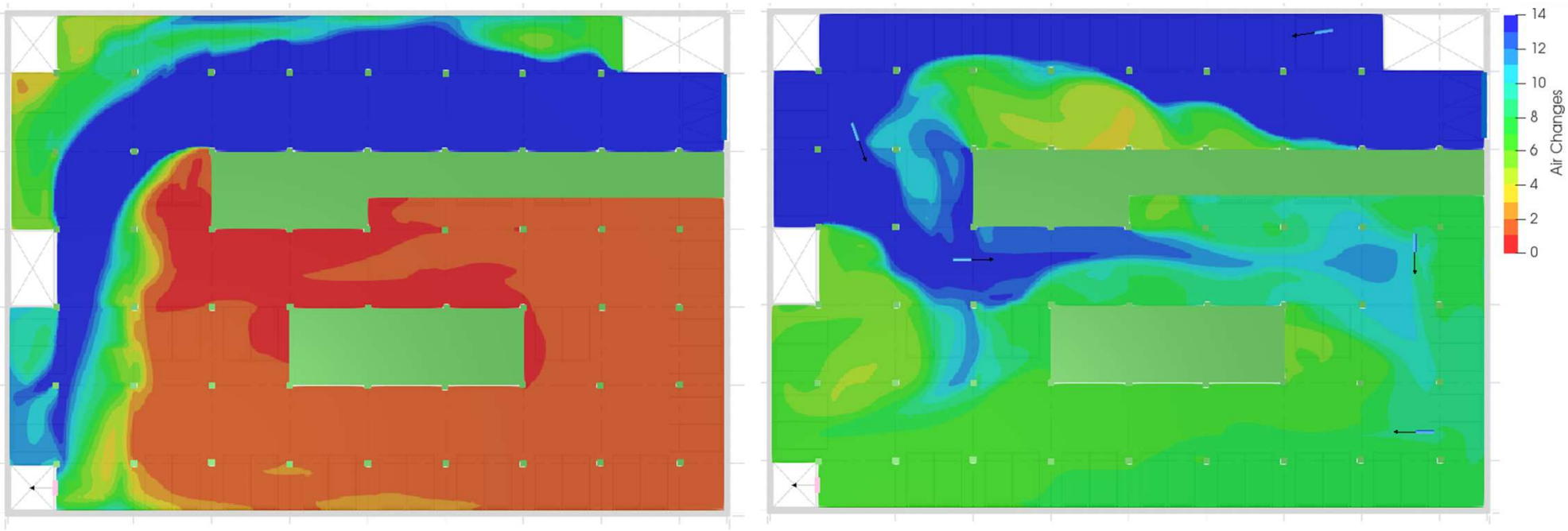


Fire Mode

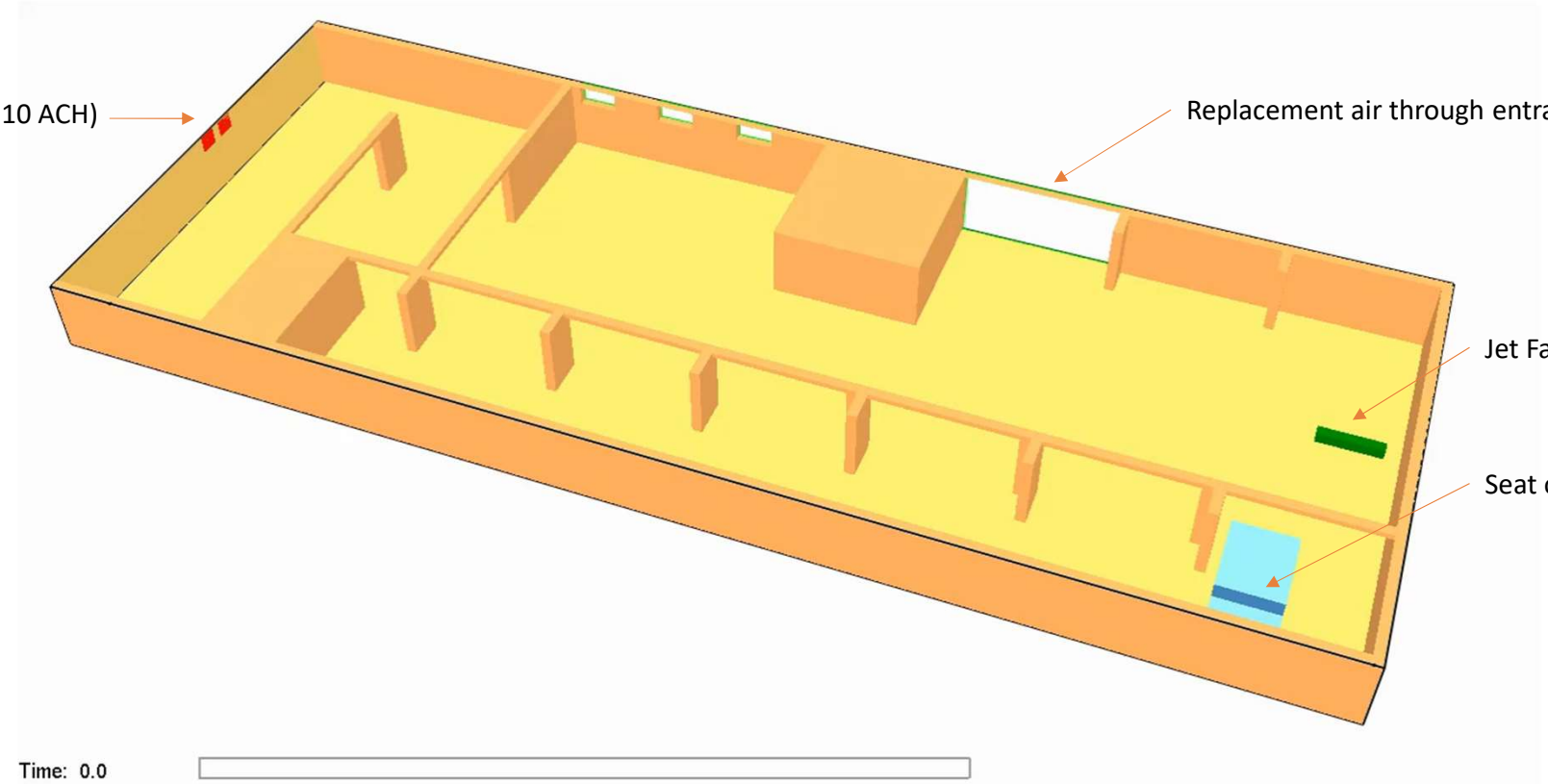
Fire mode

Deal with ***Smoke*** in the invent of a fire

Fire mode

Mechanical extract system to provide ***at least 10 ACH*** to provide ***speedier smoke clearance*** during and after a fire has been extinguished

Fire mode


Main extract (10 ACH)
Replacement air through entrance/exit
Jet Fan unit
Seat of fire
Time: 0.0

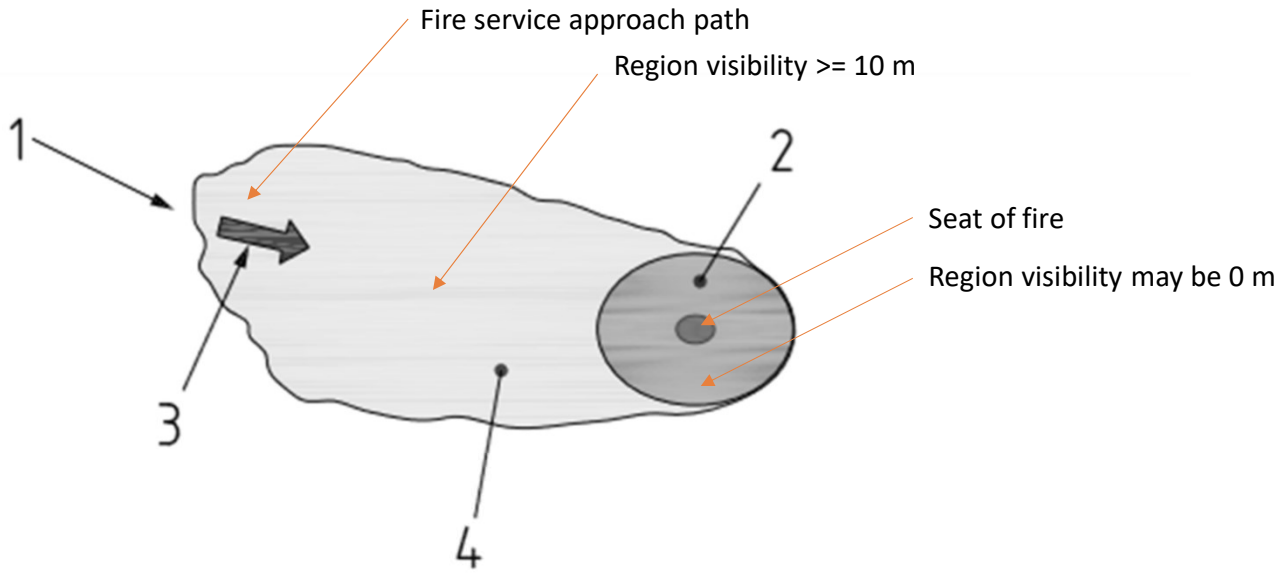
Fire mode

Section 9 **Impulse ventilation to achieve Smoke Clearance**
Assist fire-fighters by providing ventilation to allow speedier clearance of smoke once the fire has been extinghuised.

Section 10 **Impulse ventilation to assist fire-fighting access**
Aid access by the fire service to more quickly locate and tackle a fire and carry out search and resque as necessary.

Section 11 **Impulse ventilation to protect means of escape**
Protection of means of escape to preserve a smoke-free path to either the exterior of the building or a protected stairwell.

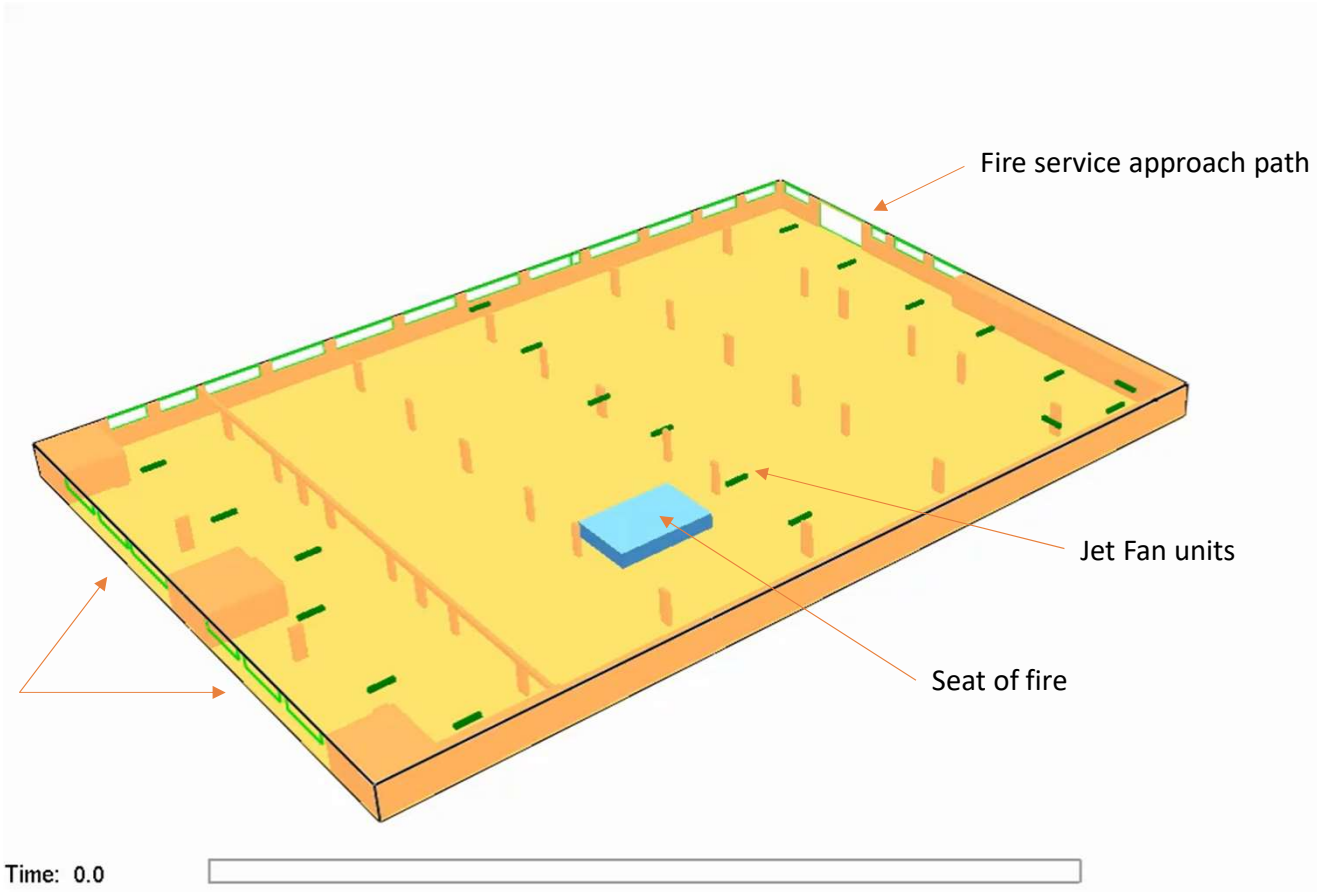
Fire mode



Key

1	Fire-fighter access point	3	Fire service approach
2	Visibility within 10 m of the fire can be zero	4	Visibility in this area is at least 10 m

Fire mode


Fire service approach path
Jet Fan units
Seat of fire
Main extract
Time: 0.0

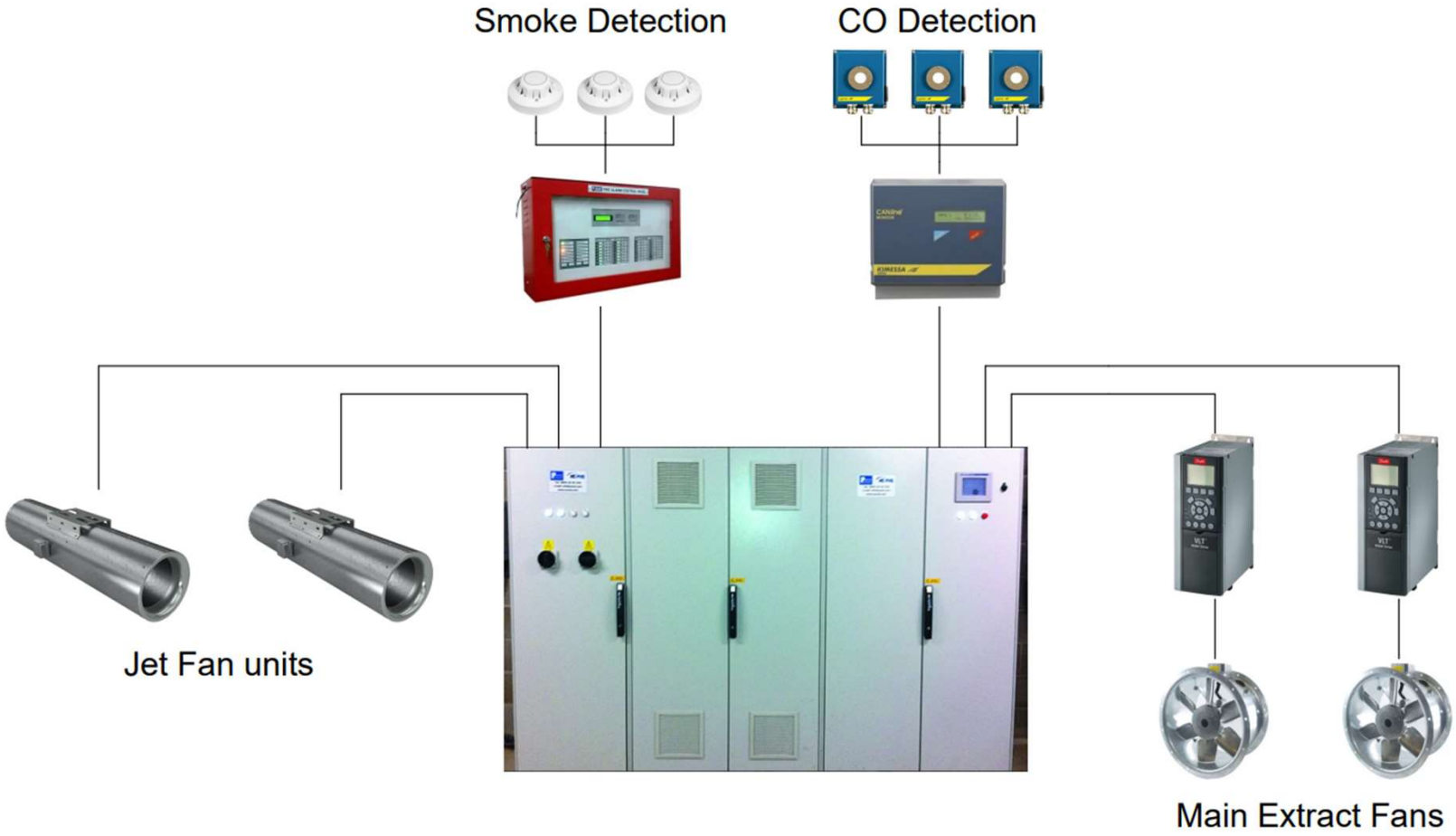
Fire mode

BS-7346 part 7:2013 – Section 10 compliant design

- Not mandatory in most countries
- Fully engineered design required, not based on fixed air flow/air change rate figures
- Minumum floor area between 4,000 and 5,000 m^2
- Requires a fully adressable fire alarm system
- Requires consultation with local fire authorities in early design stage
- Required design validation through extensive CFD analysis.

Controls

Car park ventilation solutions



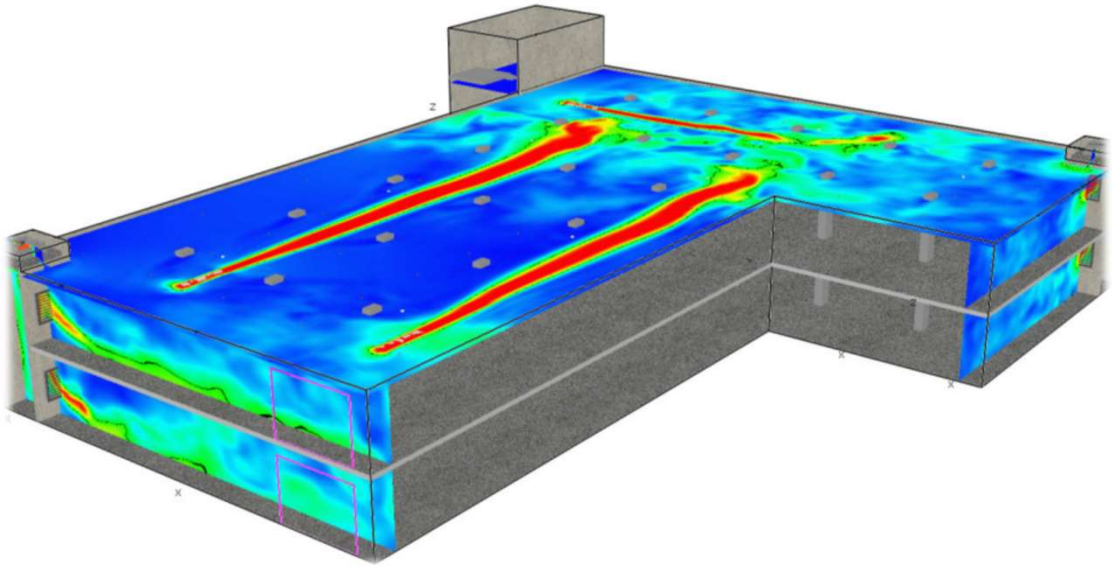
U.K. Building Regulations Approved Document F

a. an average concentration of not more than 30 parts per million over an eight hour period; and

b. peak concentrations, such as by ramps and exits, of not more than 90 parts per million for periods not exceeding 15 minutes.

Design validation through CFD analysis

Car park ventilation solutions



Allows detailed assessment of air flow patterns and behaviour by solving ***ITERATIVE*** (repeating) ***NUMMERIC EQUATIONS***

The principle

- Convert structural layout design in a CFD domain
- Devide domain into a qauntity of cells
- Within each cell resolve a number of *Navier-Stokes equations*
- Convert numeric data into graphic represenation of:
  - Air velocity profiles
  - Air quality (CO contamination levels)
  - Smoke spread
  - Smoke density & visibility
  - Temperature distribution

Car park ventilation solutions

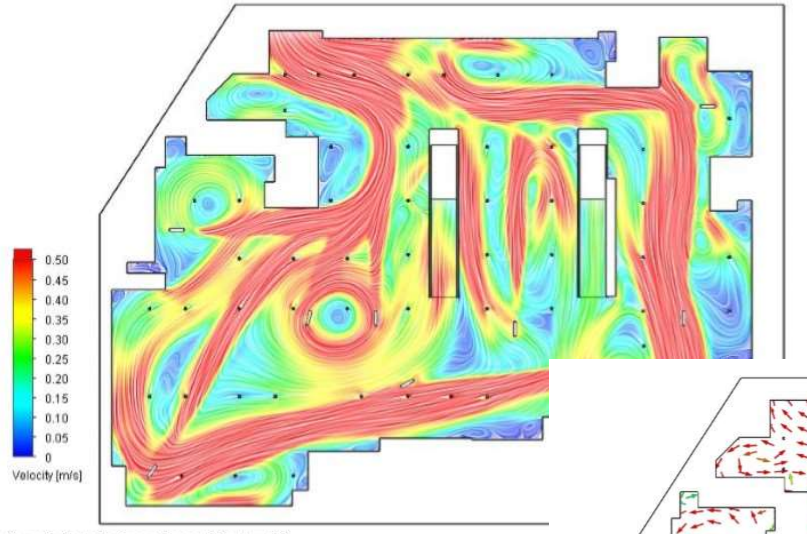
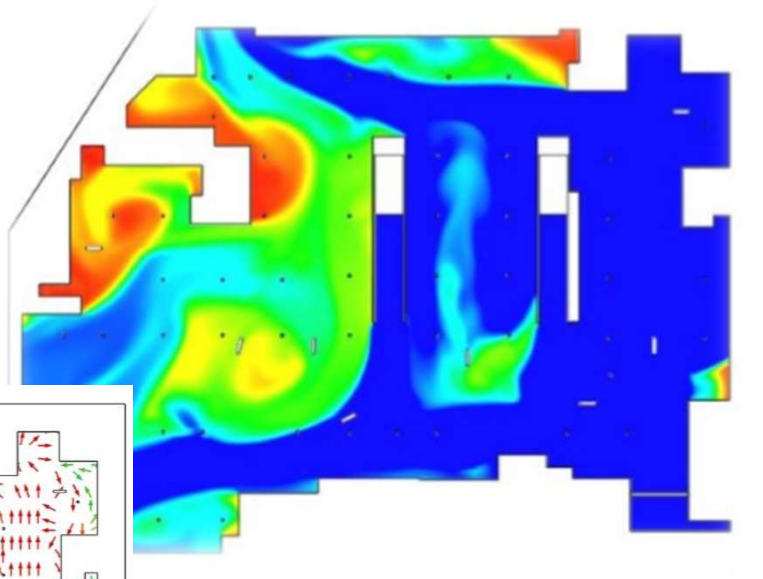


Figure 1: Velocity Streamlines at 1.8m Level 0

Figure 2: Velocity Vectors at 1.8m Level 0



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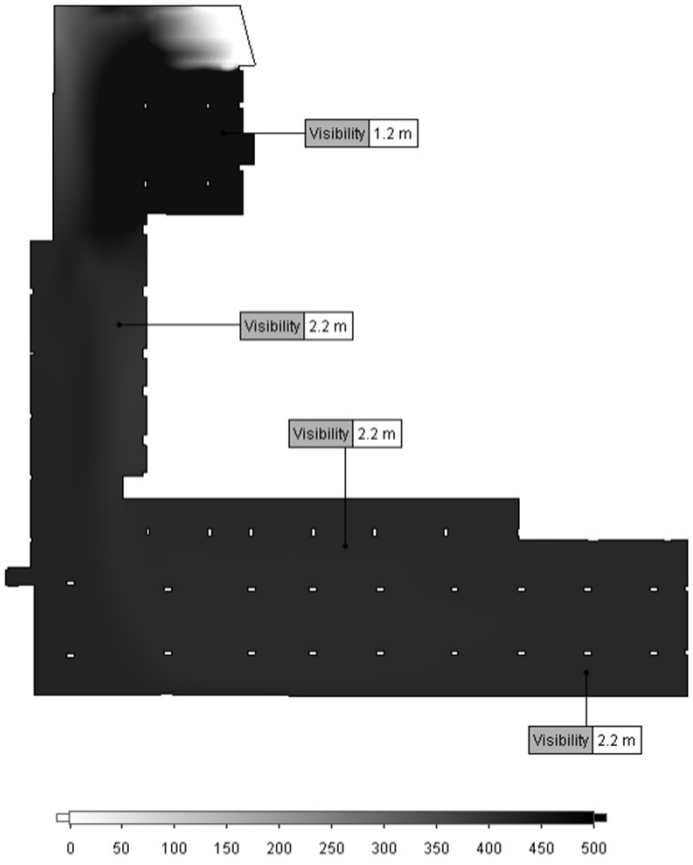

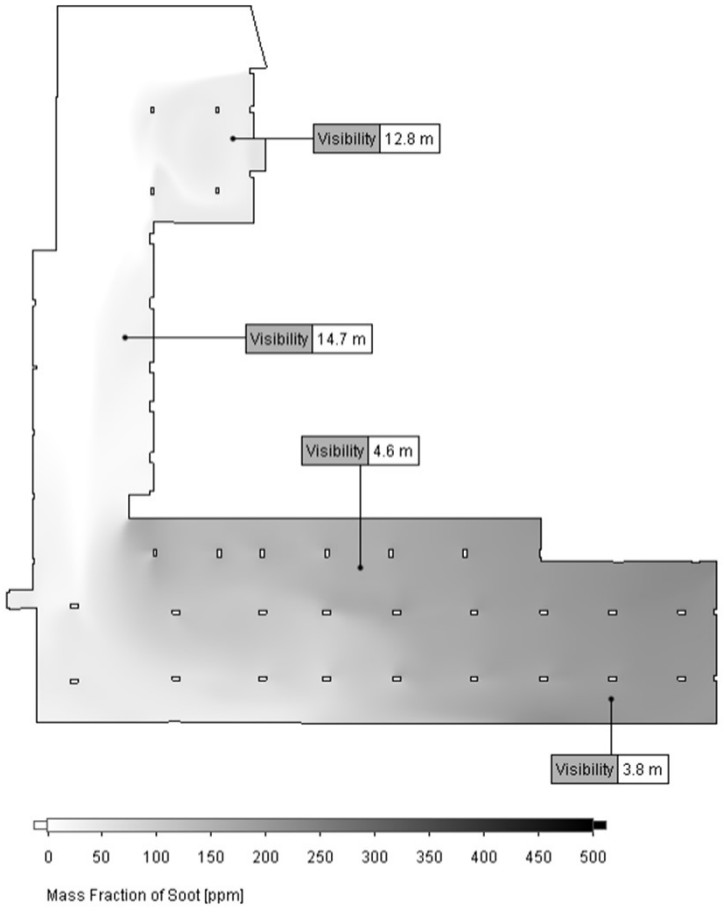

Car park ventilation solutions