Tall Buildings Conference

How does a Pressurisation System impact the Fire Safety in high-rise buildings

Smay

Ventilation Systems

Ventilation safety of tomorrow. Today.


Building Safety Act 2022
2022 CHAPTER 30
DIEU ET MON DROIT
a housing ombudsman.

Building Safety Act

The **Higher-Risk Buildings (Key Building Information etc.) (England) Regulations**, which introduce the requirement for **Principal Accountable Persons** to register Higher-Risk Buildings, will come into force on **6 April 2023**. Existing Higher-Risk Buildings must be registered **before October 2023**. The Regulations set out the **specific information** that will need to be provided to the Building Safety Regulator in an electronic format within 28 days of applying to register a building. **A significant amount of information will be required, including the materials used in the structure, roof and external walls; the number of staircases; the fire and smoke control equipment in the building;** and the type of evacuation strategy. Detailed guidance from the Building Safety Regulator is expected to be published shortly.

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Today.

Clause 33, Schedule 1 of the Building Act 1984 defines competence as possessing the appropriate "**skills, knowledge, experience, and behaviours**", and mandates that all individuals engaged in design, construction, refurbishment, and maintenance work must demonstrate competence in their respective roles.

1. NATURAL		2. TECHNICAL		3. HUMAN FACTOR	
	WIND IMPACT		CHANGING TIGHTNESS		ARCHITECTURAL LIMITATIONS / REARRANGEMENTS
	STACK EFFECT		MALFUNCTIONS		WRONG USE

1 Scope

This document gives calculation methods, guidance and requirements for the design, installation, acceptance testing, routine testing and maintenance for pressure differential systems (PDS).

PDSs are designed to hold back smoke at a leaky physical barrier in a building, such as a door (either open or closed) or other similarly restricted openings and to keep tenable conditions in escape and access routes depending on the application.

It covers systems intended to protect means of escape e.g. staircases, corridors, lobbies, as well as systems intended to provide a protected firefighting space (bridgehead) for the fire services.

It provides details on the critical features and relevant procedures for the installation.

It describes the commissioning procedures and acceptance testing criteria required to confirm that the calculated design is achieved in the building.

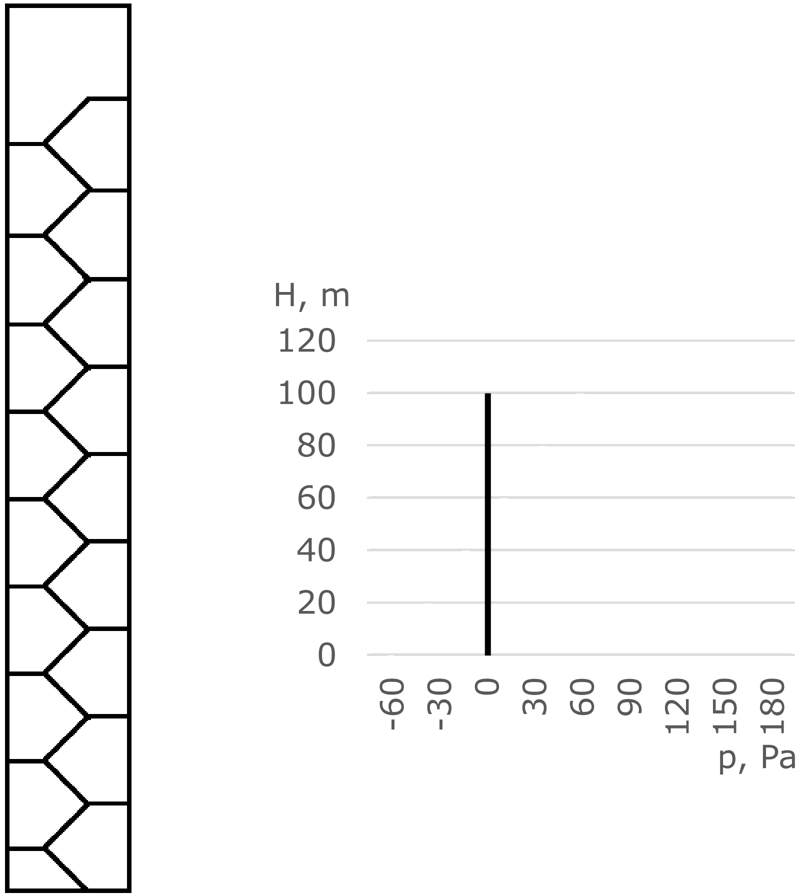
This document gives rules, requirements and procedures to design PDS for buildings up to 60 m.

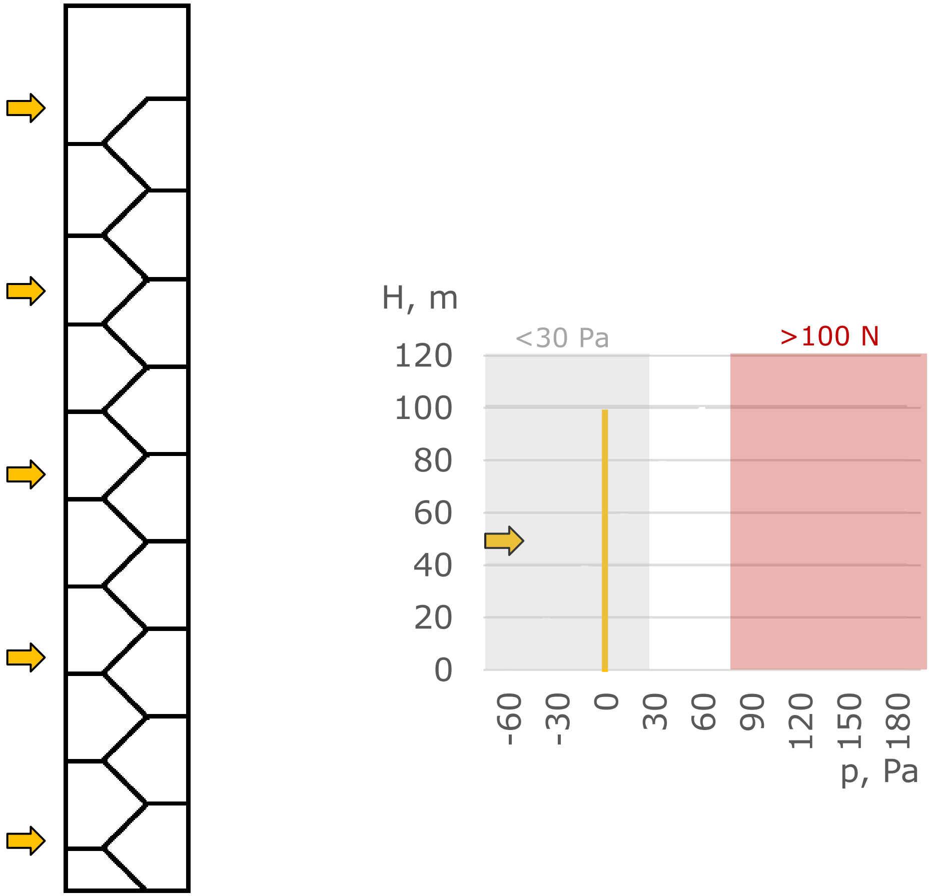
For buildings taller than 60 m the same requirements are given (e.g. Table 1), but additional methods of calculation and verification are necessary. Requirements for such methods and verification are given in Annex D, but the methods fall outside the scope of this document [e.g. Additional mathematical analysis and/or Computational Fluid Dynamics (CFD)].

PRESSURE TOO LOW
<30 Pa

PRESSURE TOO HIGH
>100 N

ISOTHERMAL
T_{out}= 20°C



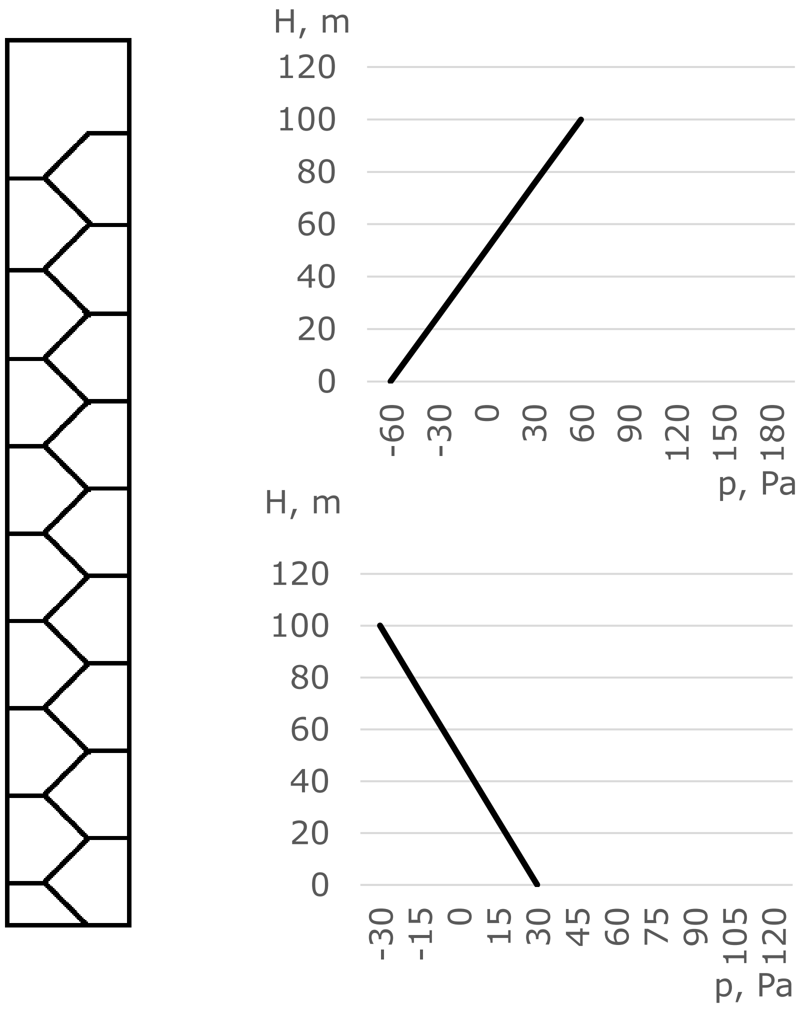


NATURAL DISTRIBUTION

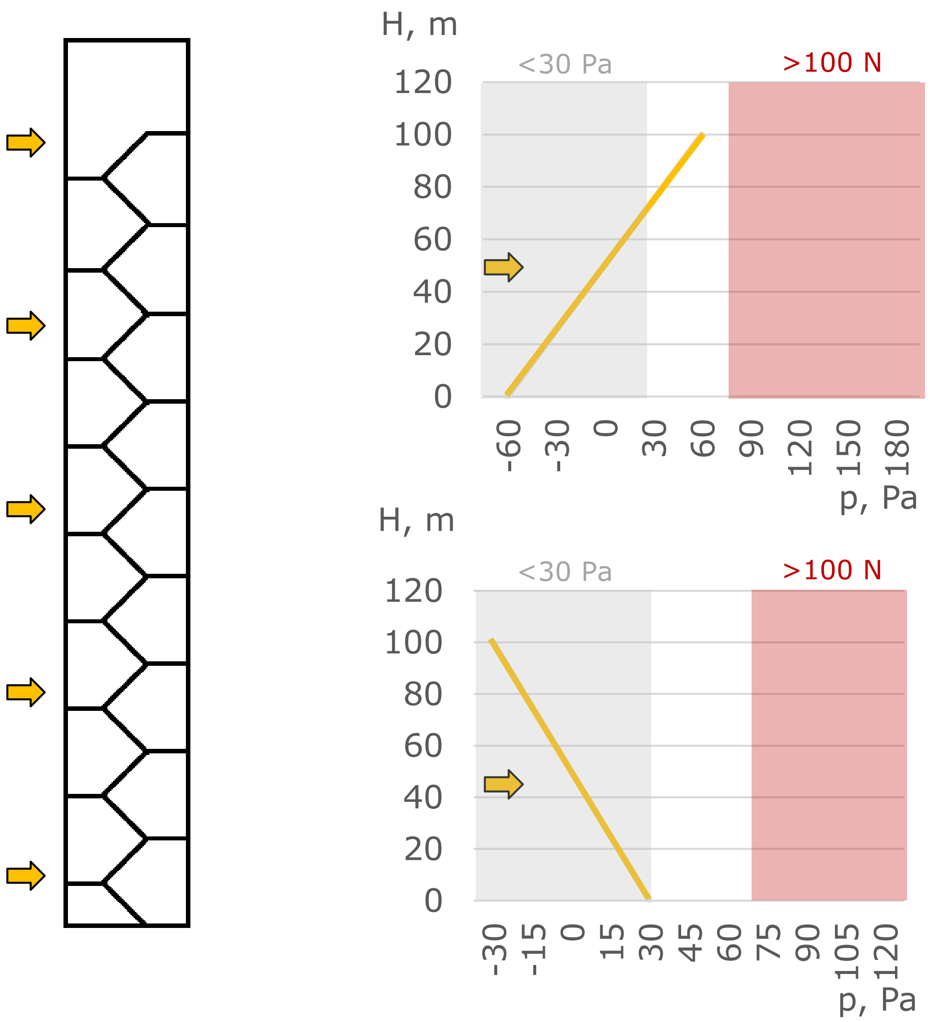
PRESSURIZATION

WINTER
T_{out}= -10°C

SUMMER
T_{out}= 38°C

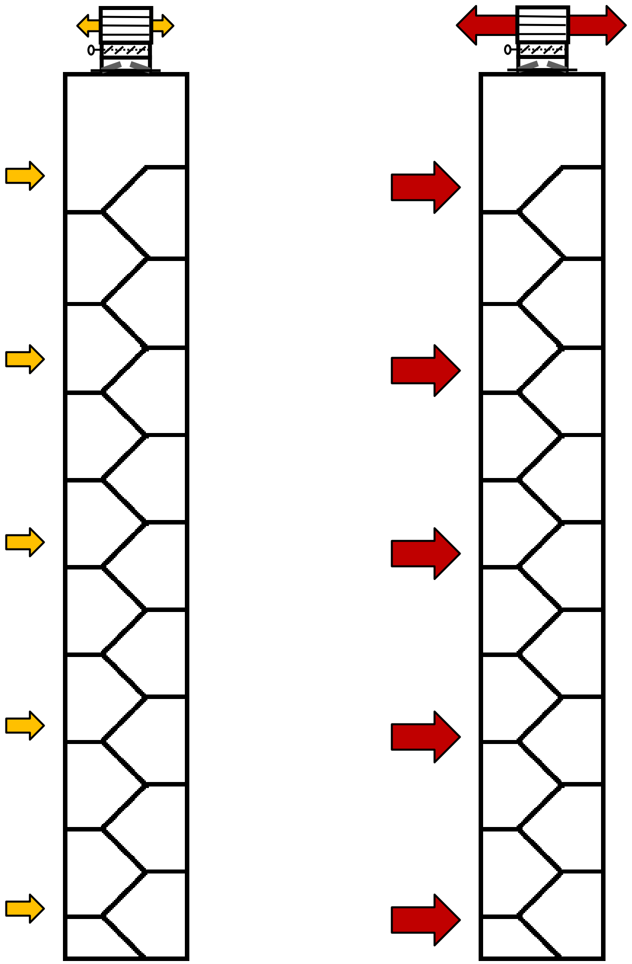


NATURAL DISTRIBUTION

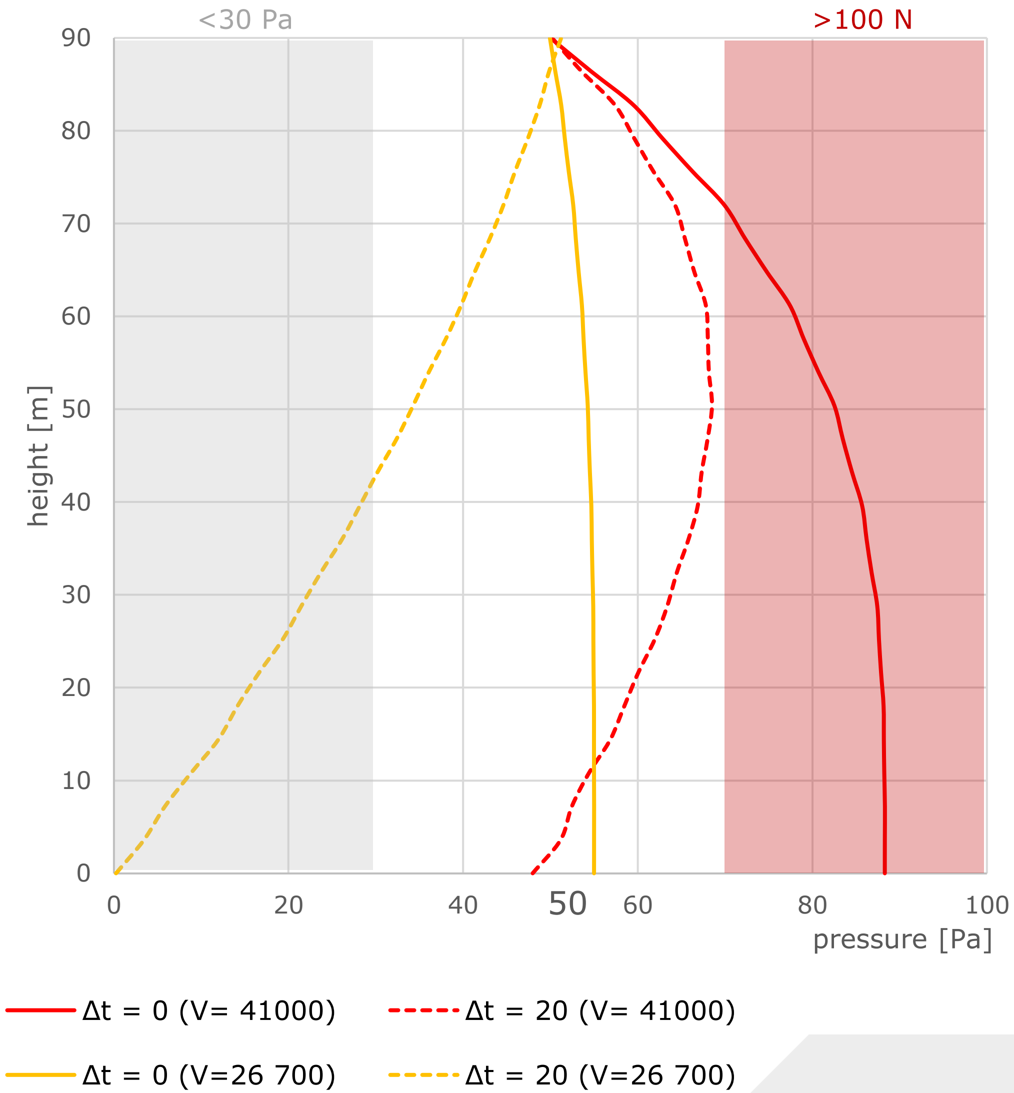


PRESSURIZATION

PRESSURE DISTRIBUTION
DIFFERENT PDS, 90m BUILDING



CONSTANT AIR VOLUME
V=26700 m³/h **V=41000 m³/h**



EN12101-6:2005

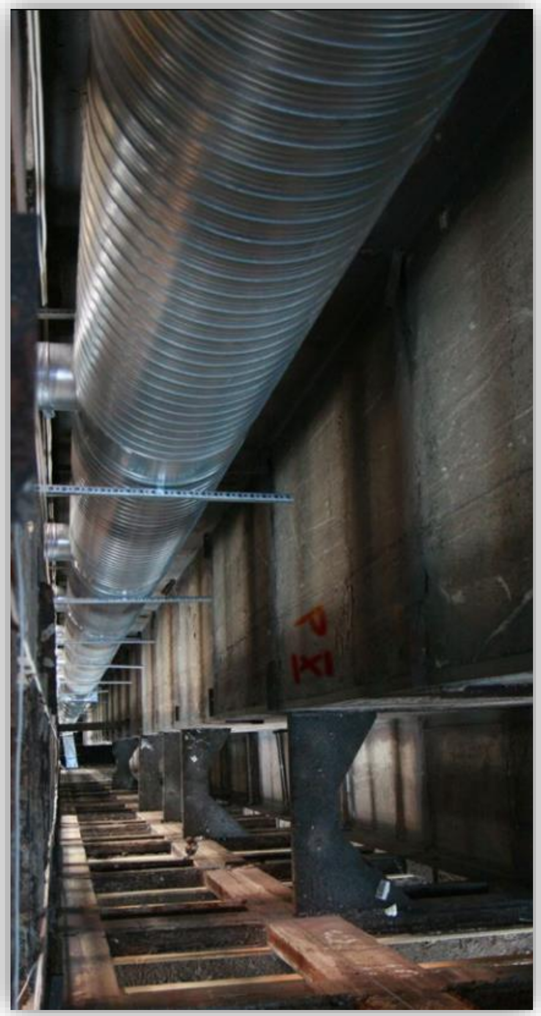
Annex B
(informative)

Solutions for inability to obtain design pressure differential

The following guidance relates specifically to pressurization systems. However, similar principles, suitably adapted, may also be applied to depressurization systems.

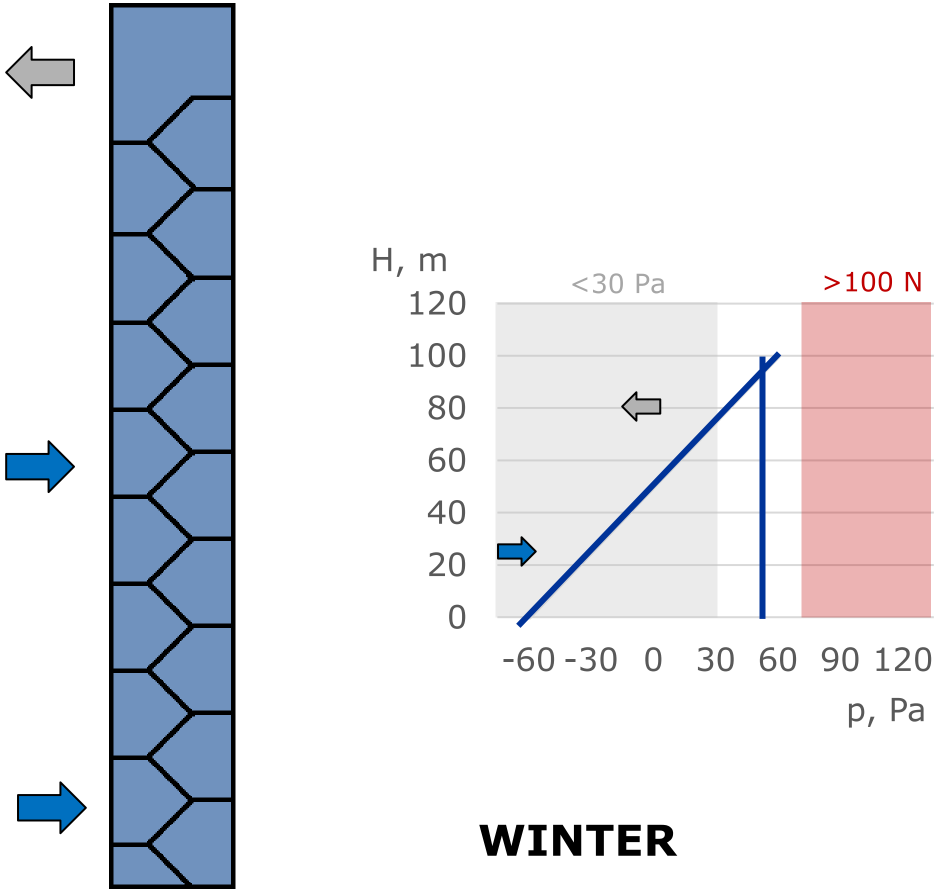
B.1 The pressure differentials recommended in this document are intended to take account of fire buoyancy and external wind conditions. If tests are carried out where external conditions give rise to high wind and gusts, it may not be possible to achieve the design pressure differential.

B.2 Where stack effect is likely to be a significant factor, this may be minimized by operating the pressure differential system for a period of one hour before testing so that the external air and shaft temperatures can equalize.

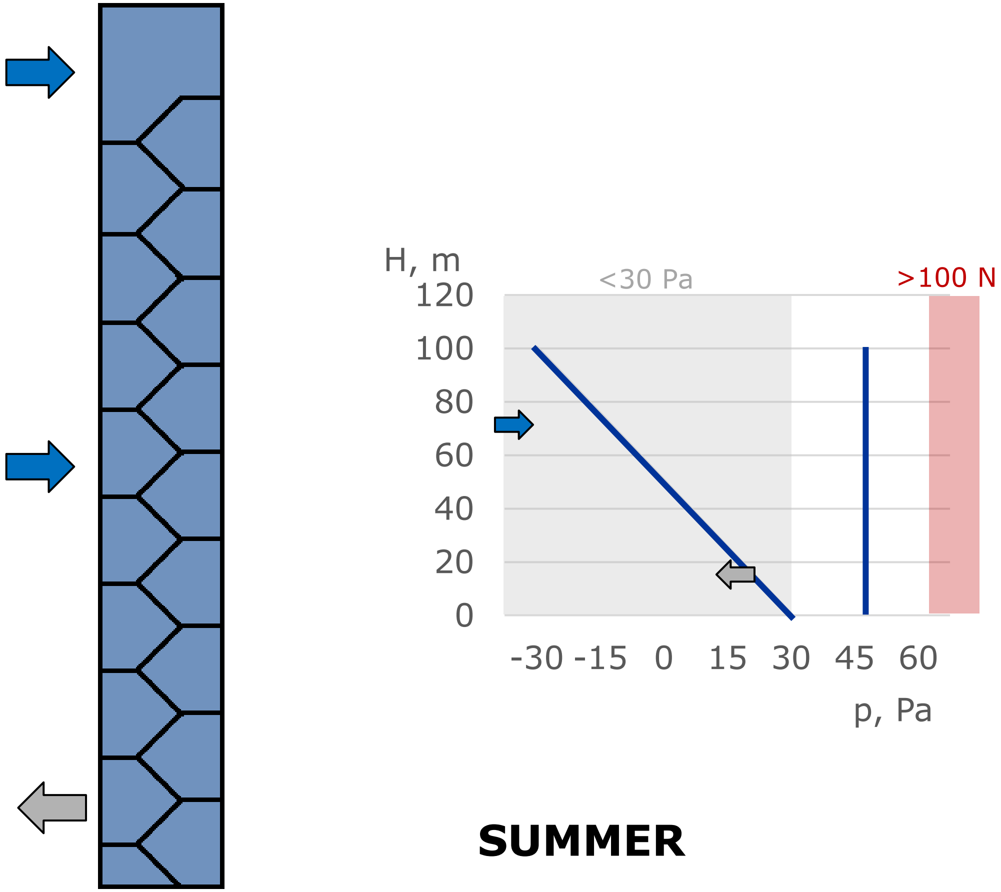


REAL SCALE TESTING	
LOCATION	**CRACOW**
BUILDING	**23°, H=90 m**
TIME	**10.2008 – 09.2010**

CASE STUDY ON RECONSTRUCTION:
SMAY.PL/PDS

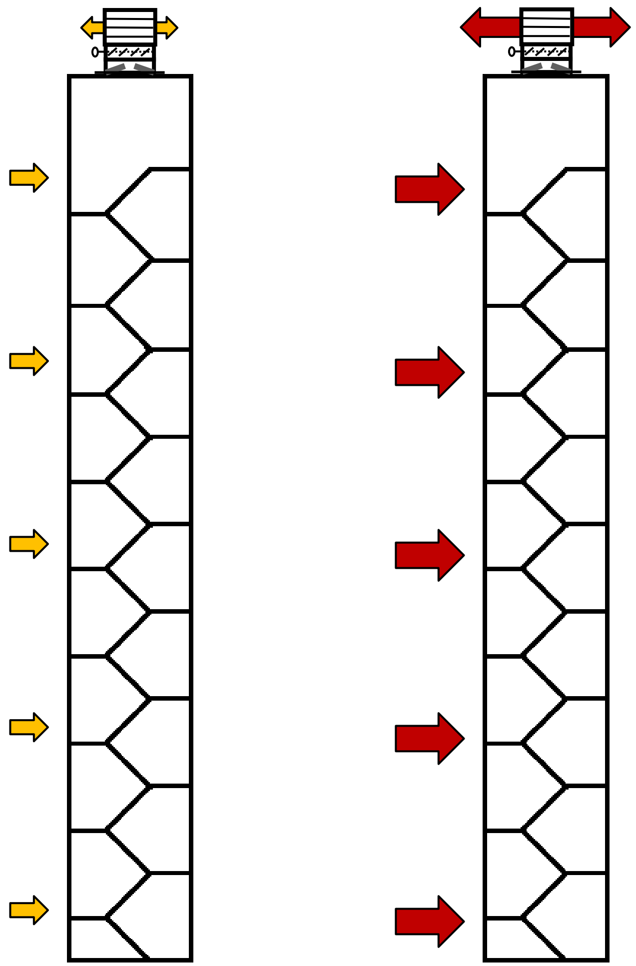


WINTER



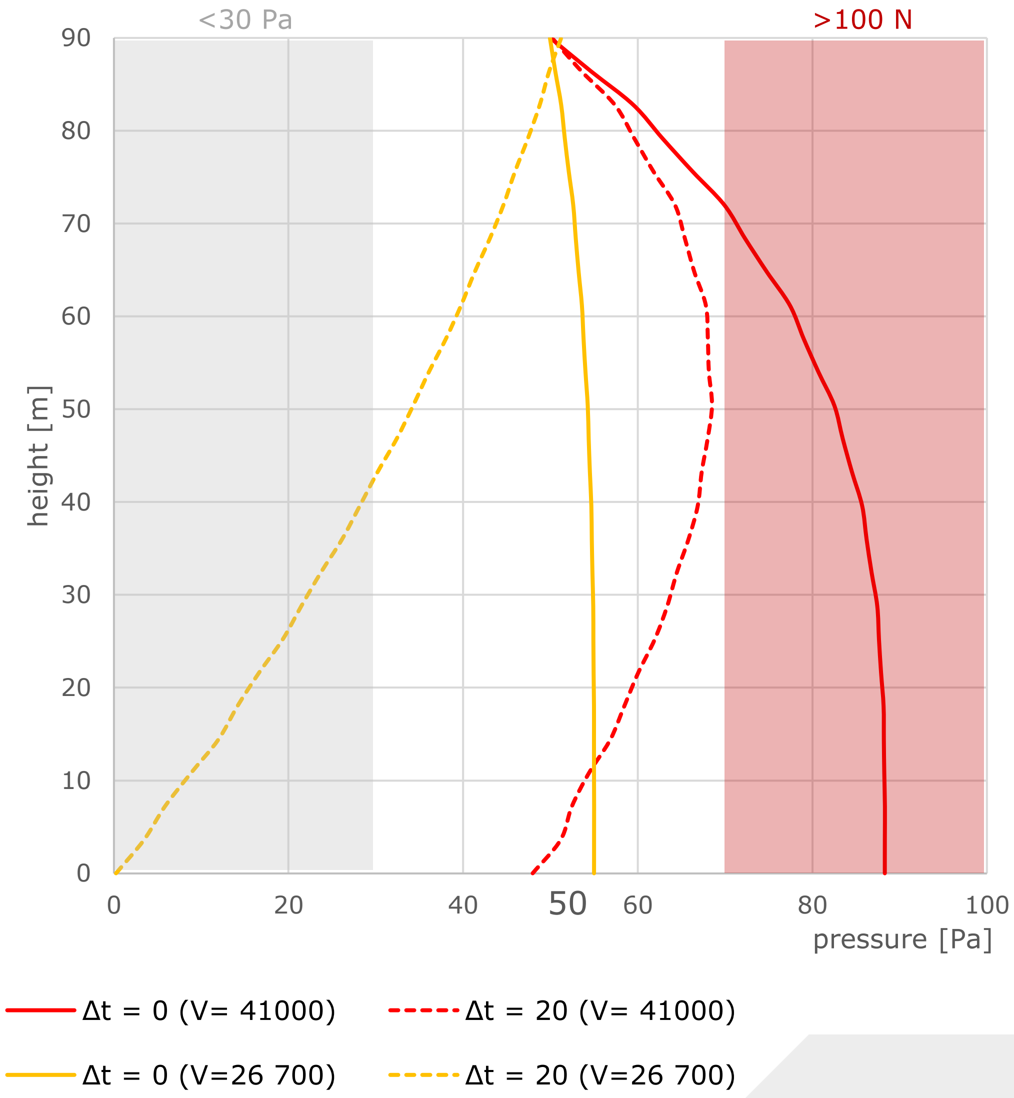
SUMMER

PRESSURE DISTRIBUTION
DIFFERENT PDS, 90m BUILDING

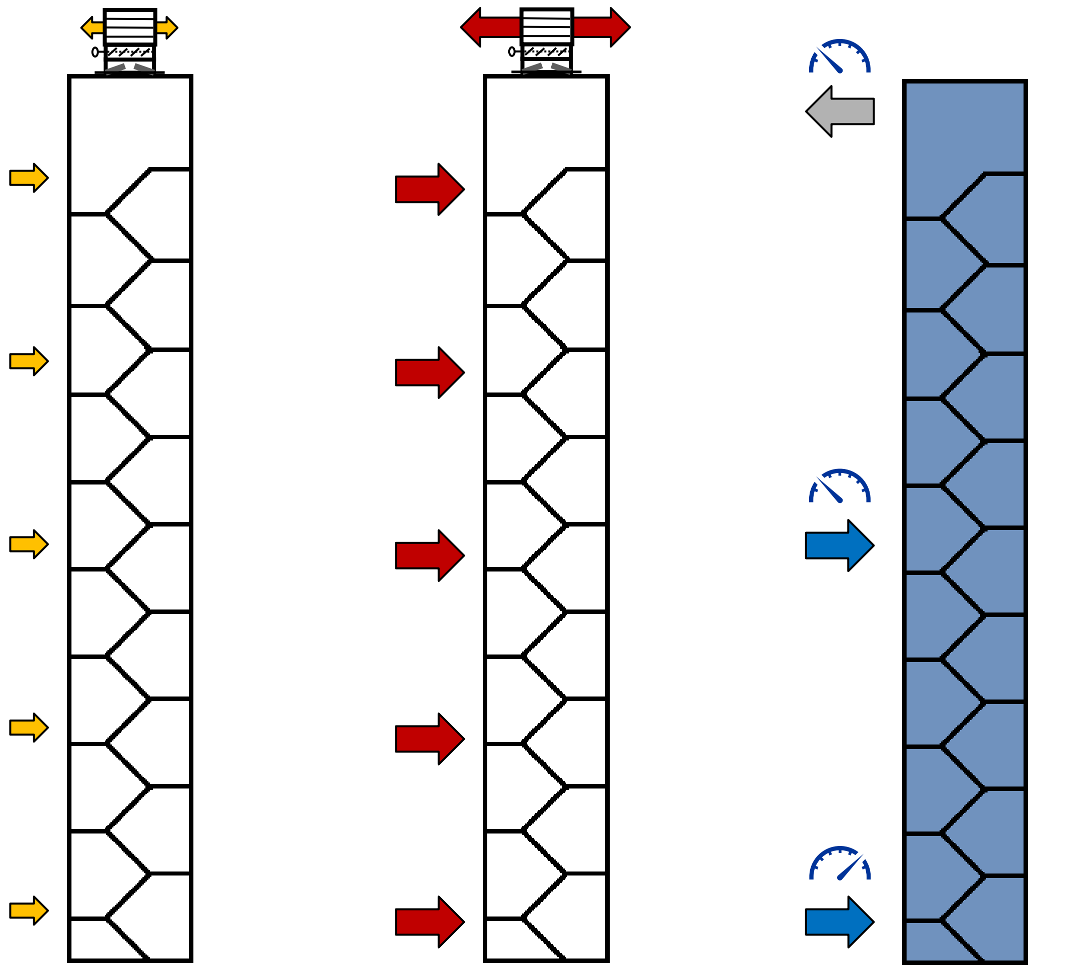


CONSTANT AIR VOLUME

V=26700 m³/h **V=41000 m³/h**



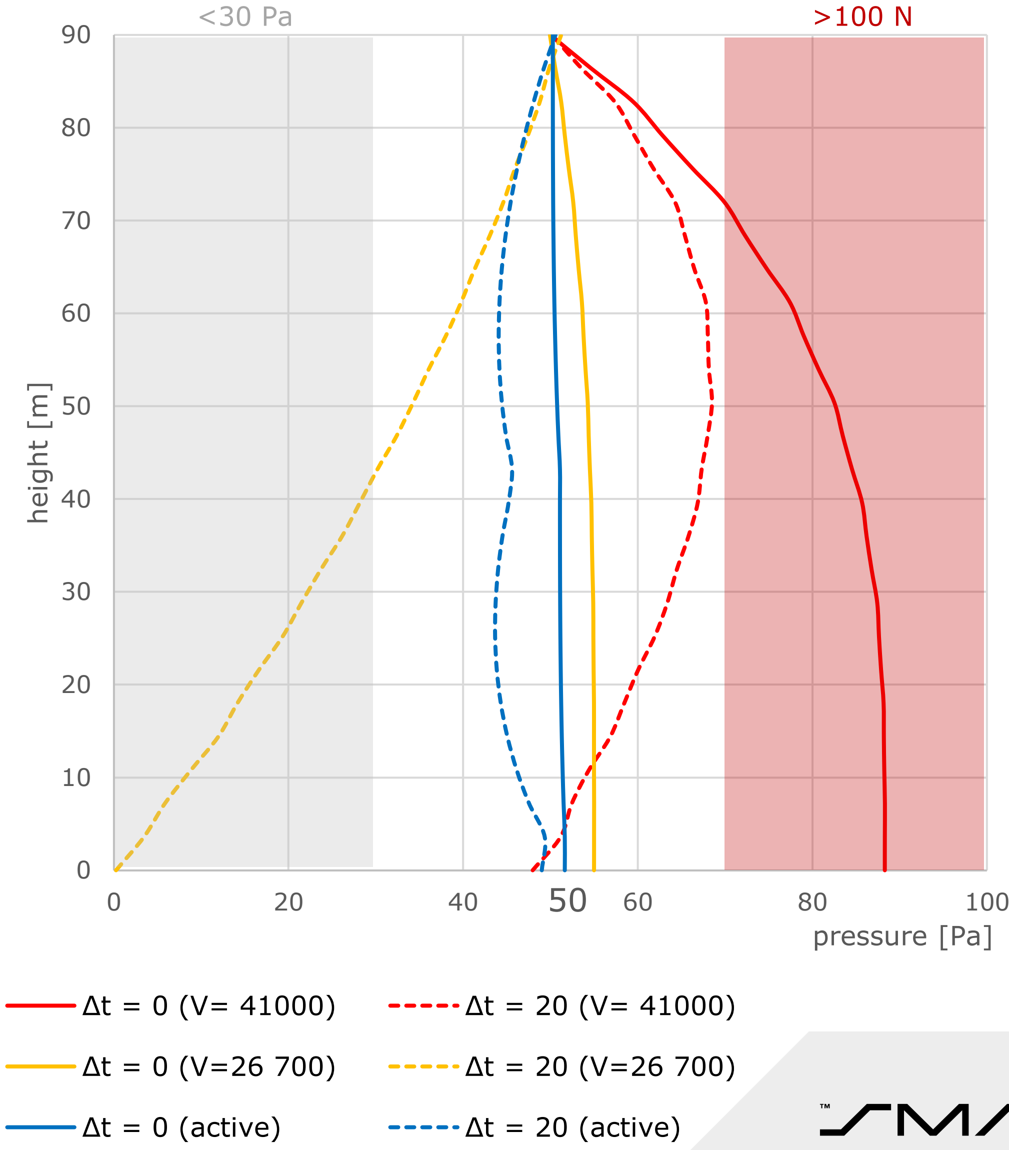
PRESSURE DISTRIBUTION
DIFFERENT PDS, 90m BUILDING



CONSTANT AIR VOLUME

V=26700 m³/h **V=41000 m³/h**

ADAPTIVE FLOW SYSTEM



Smay
Ventilation
Systems

SUPPORT
ADDITIONAL MATHEMATICAL ANALYSIS

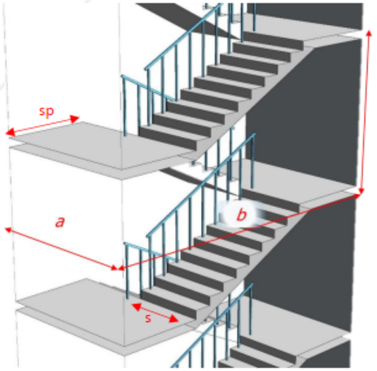
SMAY Sp. z o.o.
Podłęże 678
30-003 Podłęże,
POLAND

VAT UE: PL6782821888

smay.eu

DESCRIPTION AND ASSUMPTIONS FOR ANALYSIS:

- **Goal of the analysis**: determination of pressure distribution in the staircase during the operation of the pressure differentiation system
- Height of the staircase: 87,5 m (82,4 m above ground and 5,1 m underground)
- Tightness level: average in accordance to EN 12101-6
- Method of analysis: analytical calculations of pressure inside the staircase taking into account the stack effect, flow resistance, leakage
- All doors are closed
- The correct operation of the pressure differential system (PDS) requires pressure regulation within the corridors, which was not the subject of the analysis
- Location of air supply points:
  - Reversible top iSWAY unit: L23
  - Additional iSWAY unit: L06, L08, L10, L12, L14, L16, L18, L20
  - Reversible bottom iSWAY unit: LGround, L02, L04,
- the analysis was performed for summer, isothermal and winter conditions
- staircase geometry:
  - a = 3,0 m
  - b = 5,25 m
  - sp = 1,425 m
  - s = 1,40 m
  - h = 3,25 ÷ 4,11 m (above ground)
  - h = 2,95 ÷ 4,32 m (underground)



RESULTS OF THE ANALYSIS:

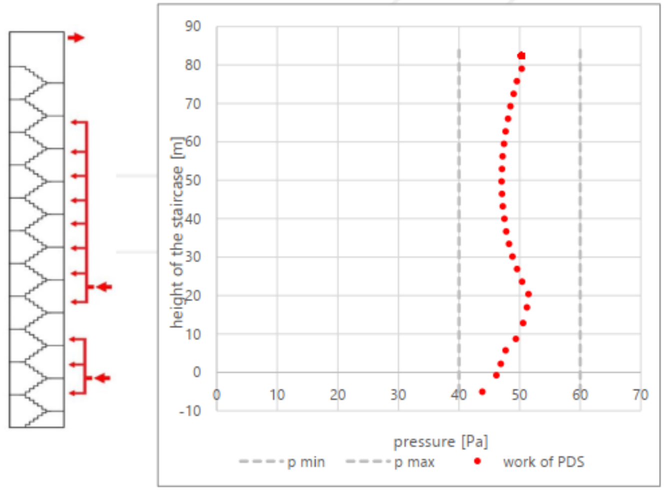
Winter conditions

Pressure differences between staircase and outside

Temperature **outside** in winter	T_{out}	0	[°C]
Temperature **inside** in winter	T_{inn}	18	[°C]

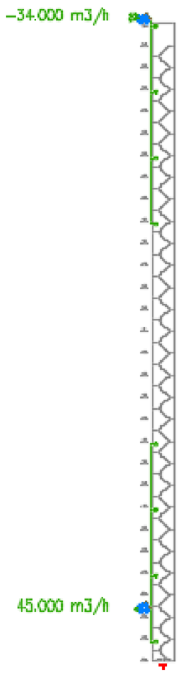
Outlet volume flow (top)	V_{out}	- 12 600	[m³/h]
Additional volume flow (middle)	V_{add}	5 000	[m³/h]
Inlet volume flow (down)	V_{inn}	21 200	[m³/h]

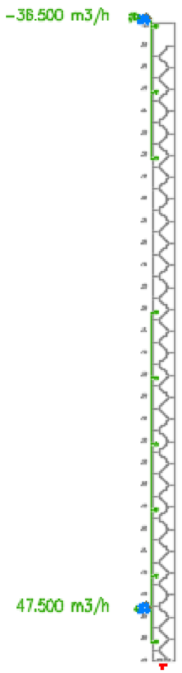
Figure 01. Pressure differences between staircase and outside due to work of Pressure Differential System (PDS) in winter conditions

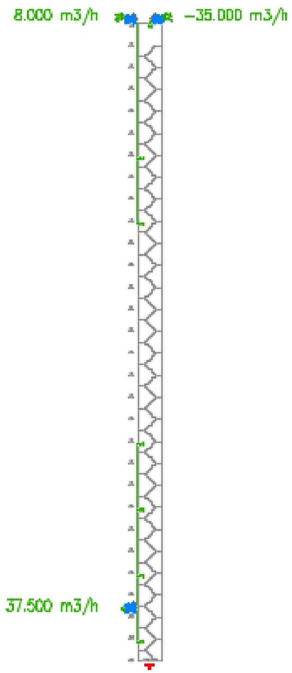


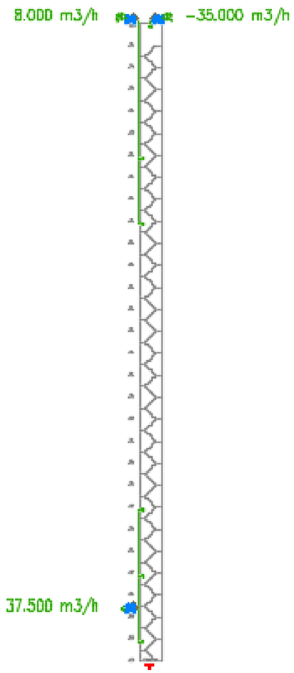
Smay
Ventilation
Systems

SUPPORT
ADDITIONAL MATHEMATICAL ANALYSIS



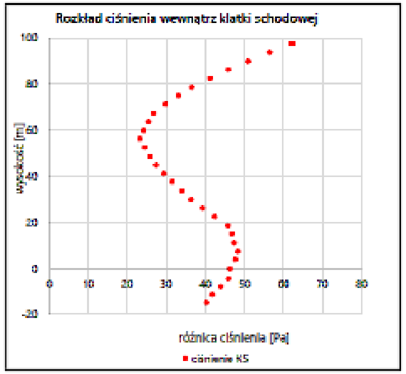


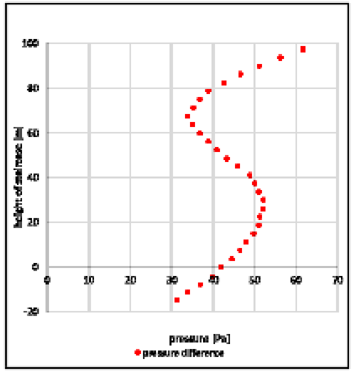


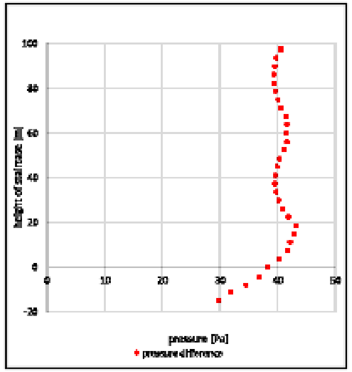


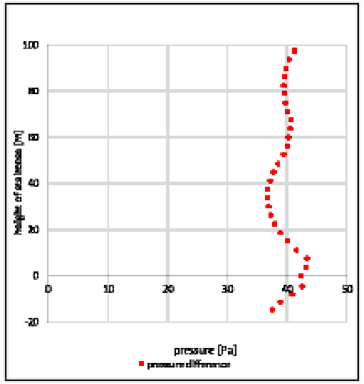
[illegible]

Temperatura zewnętrzna w zimie	T	-20	[°C]
Temperatura wewnętrzna w zimie	T	16	[°C]

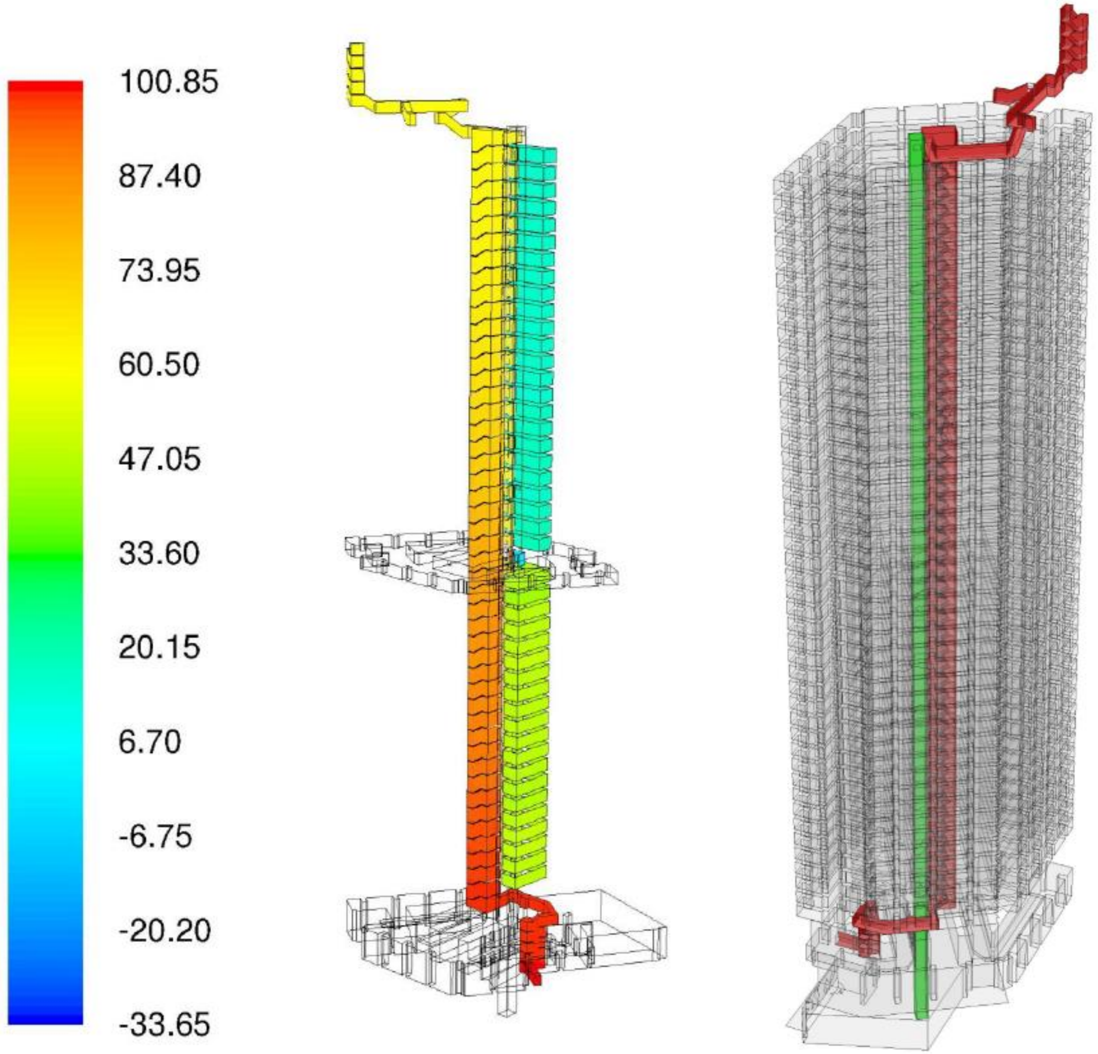


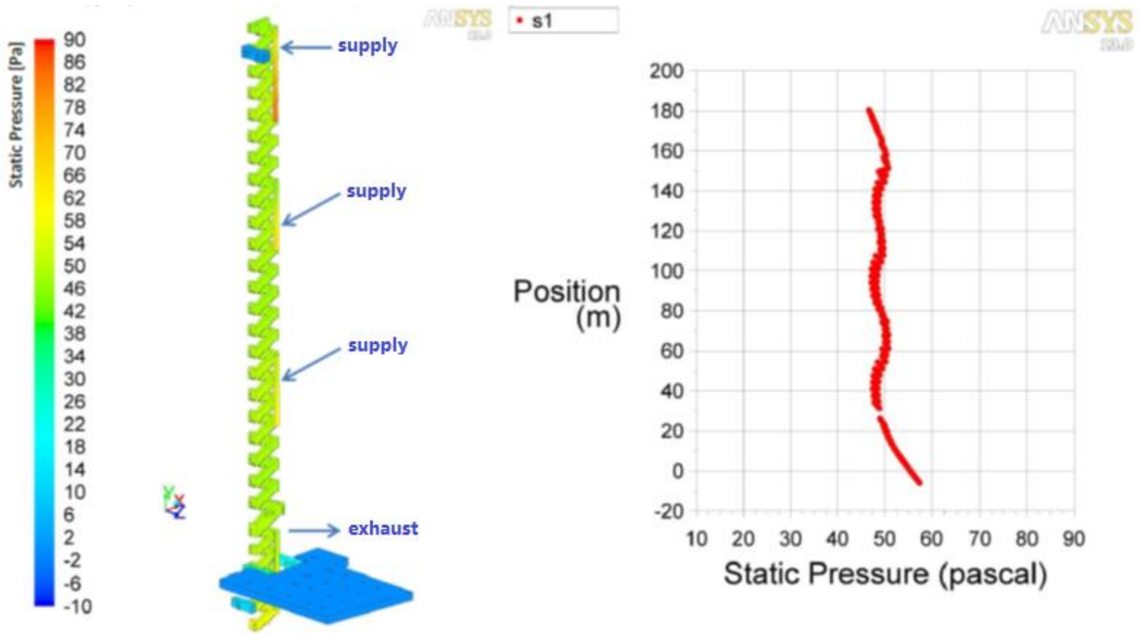




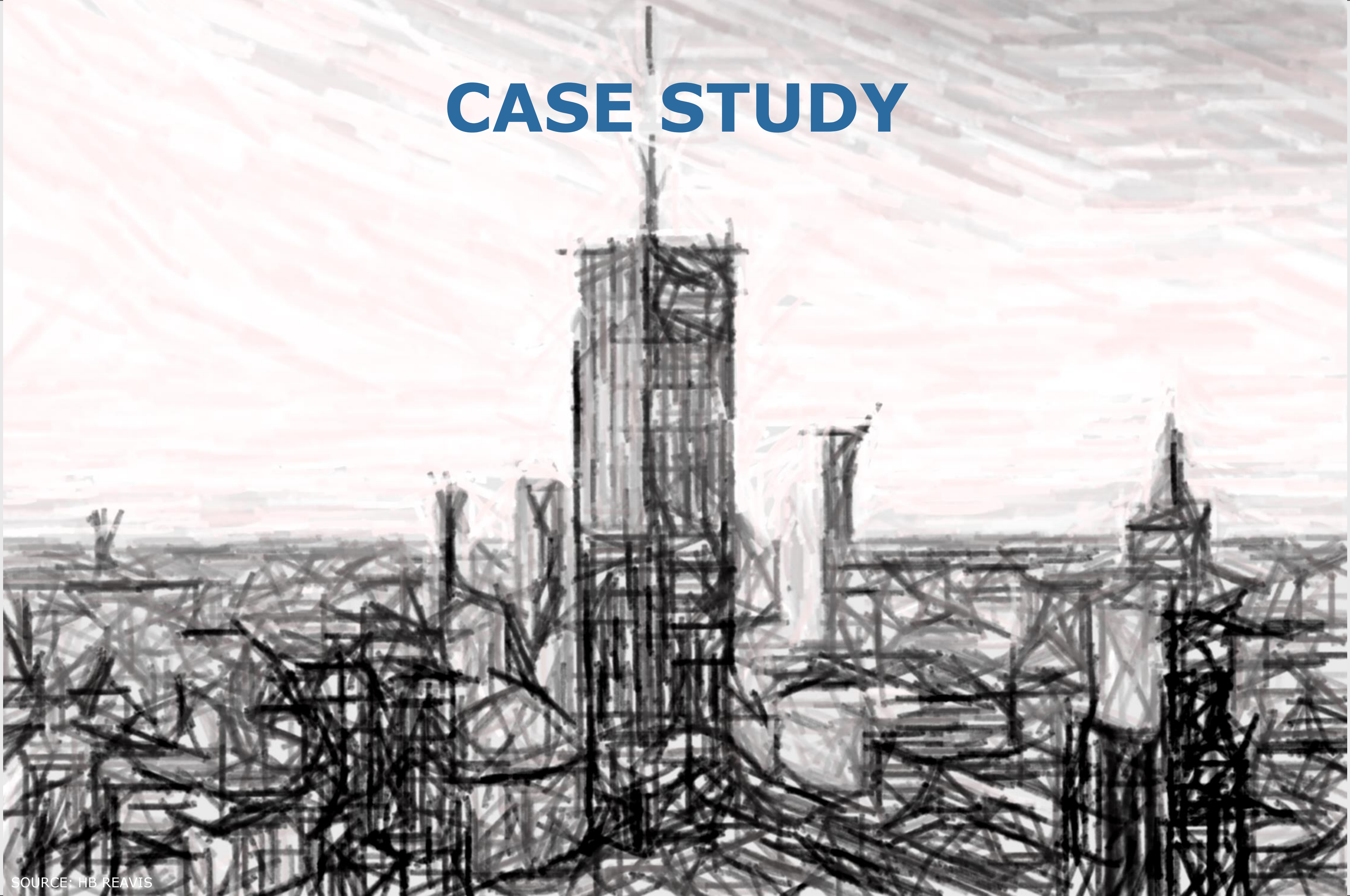


SUPPORT
CFD SIMULATIONS





CASE STUDY



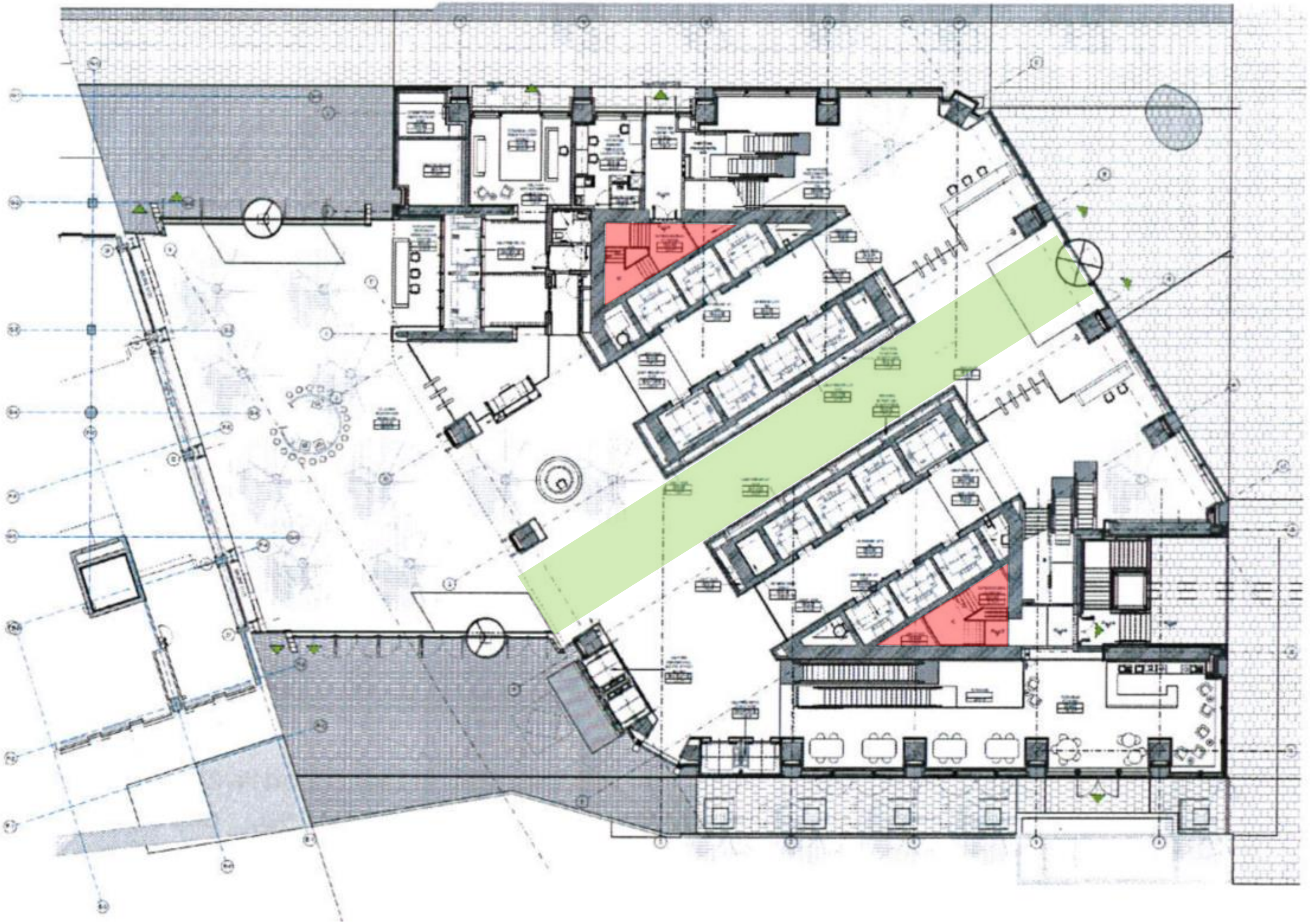
SOURCE: HB REAVIS

SOURCE: HB-REAVIS

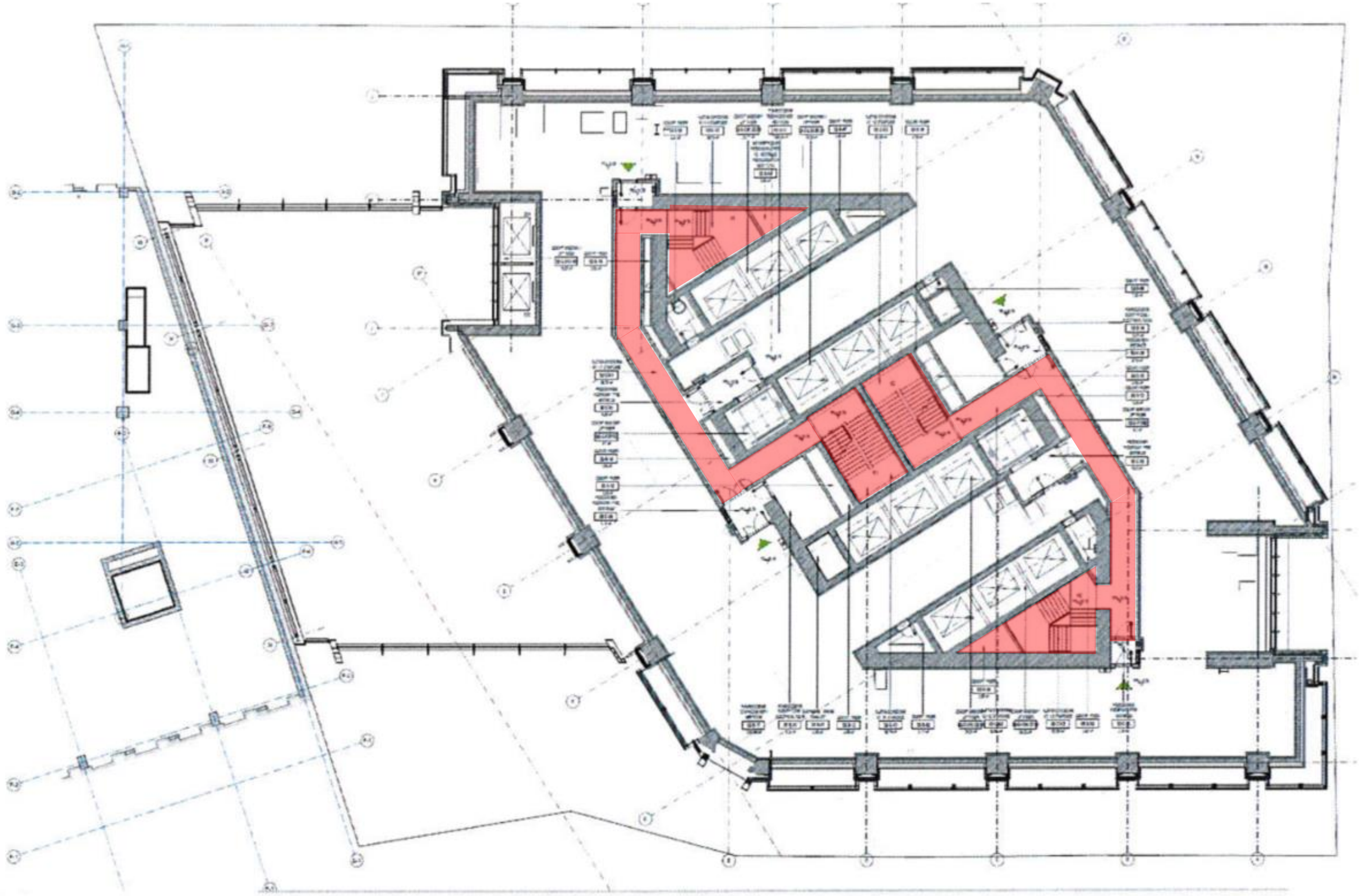
SOURCE: HB REAVIS


SOURCE: HB REAVIS

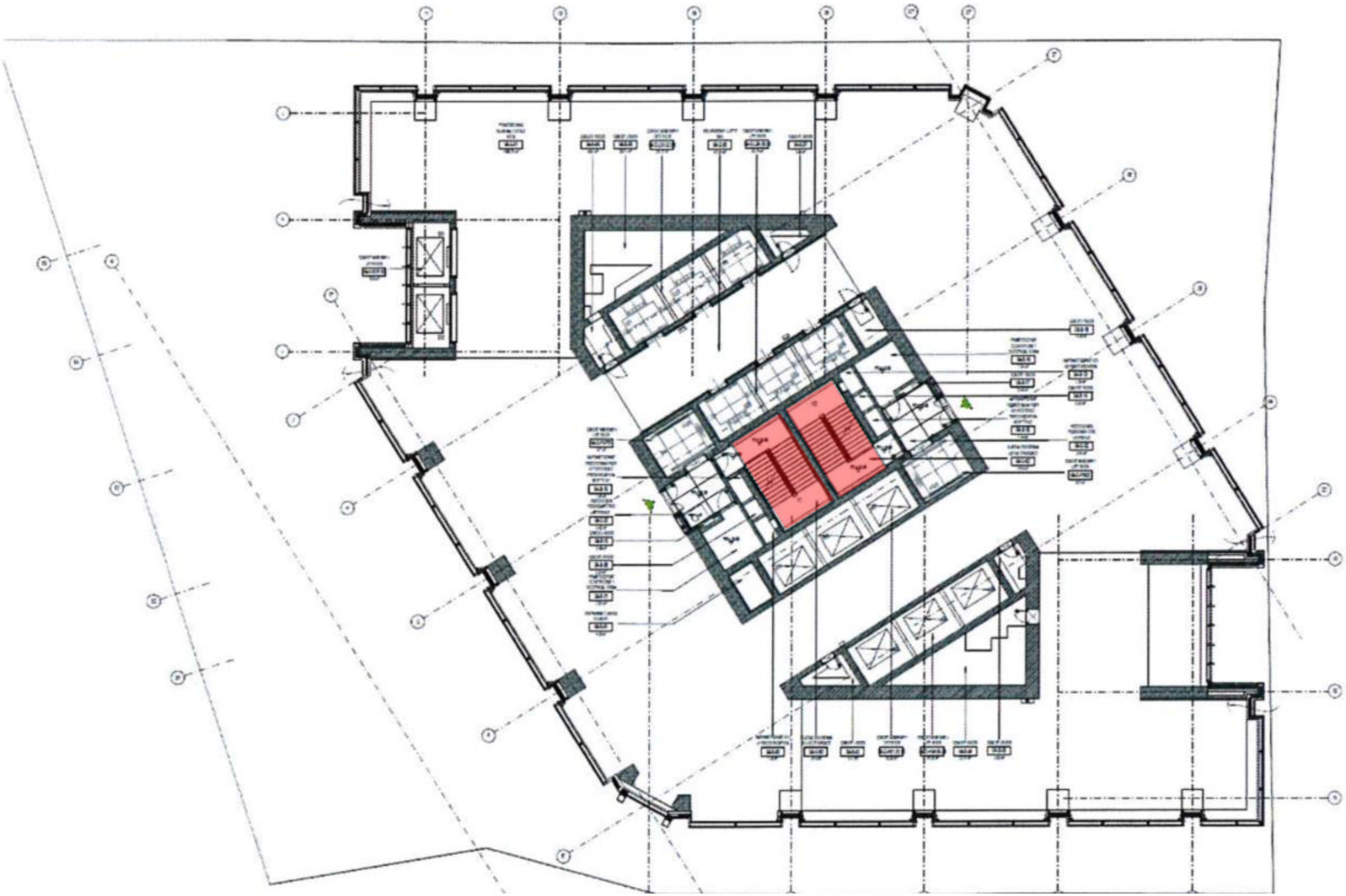
GROUND FLOOR



LEVEL 02

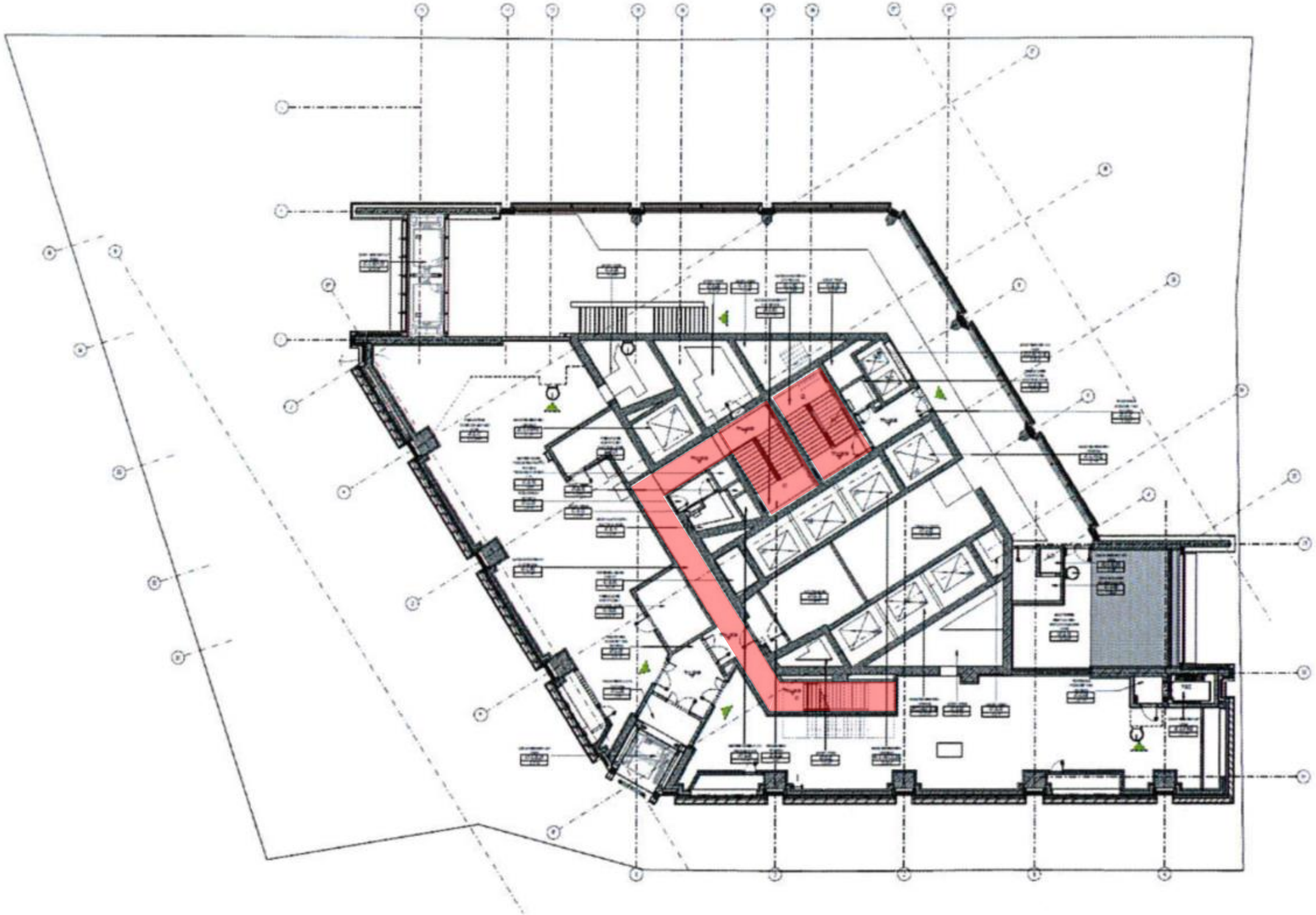


LEVELS 04-46

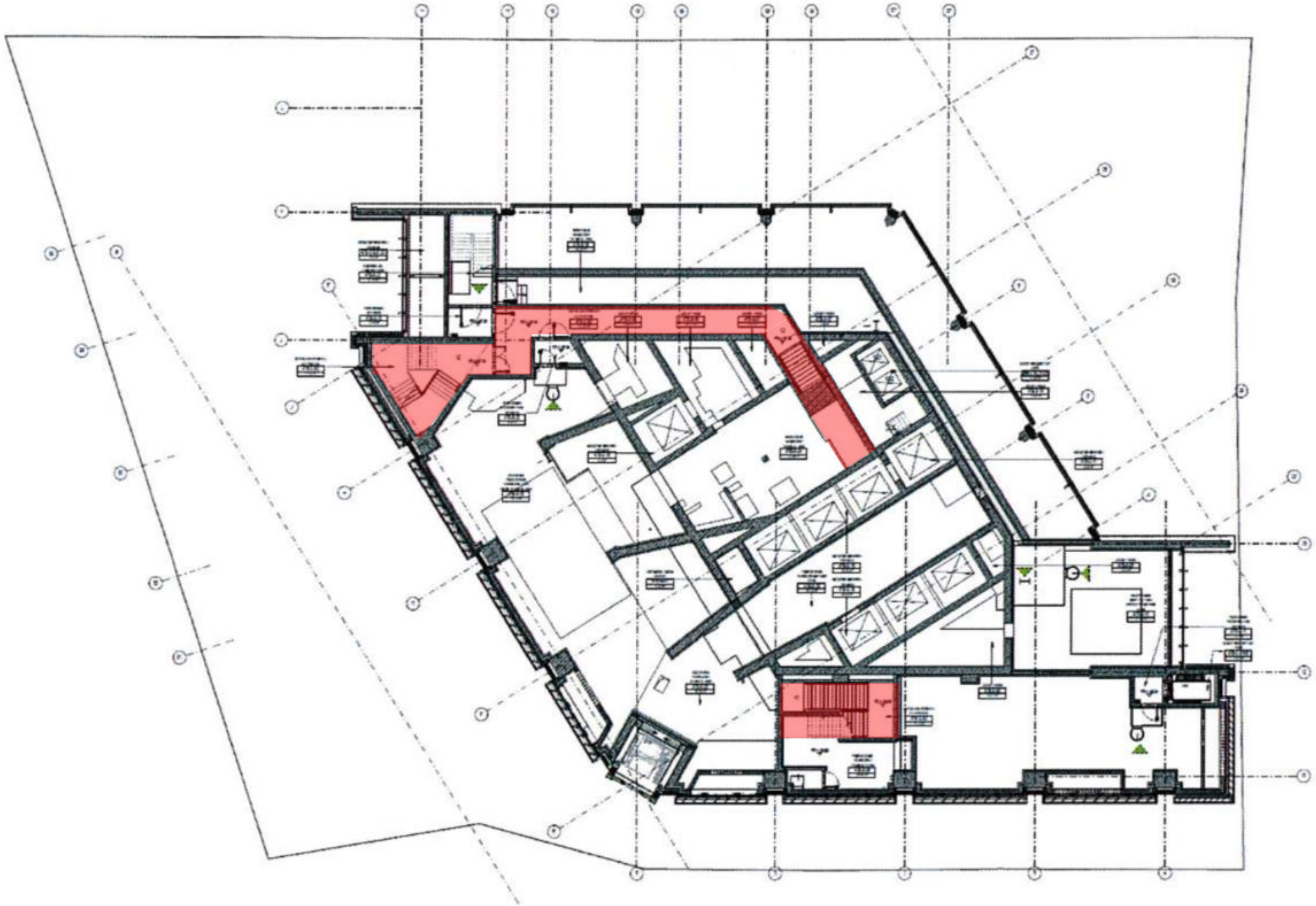


SMAY

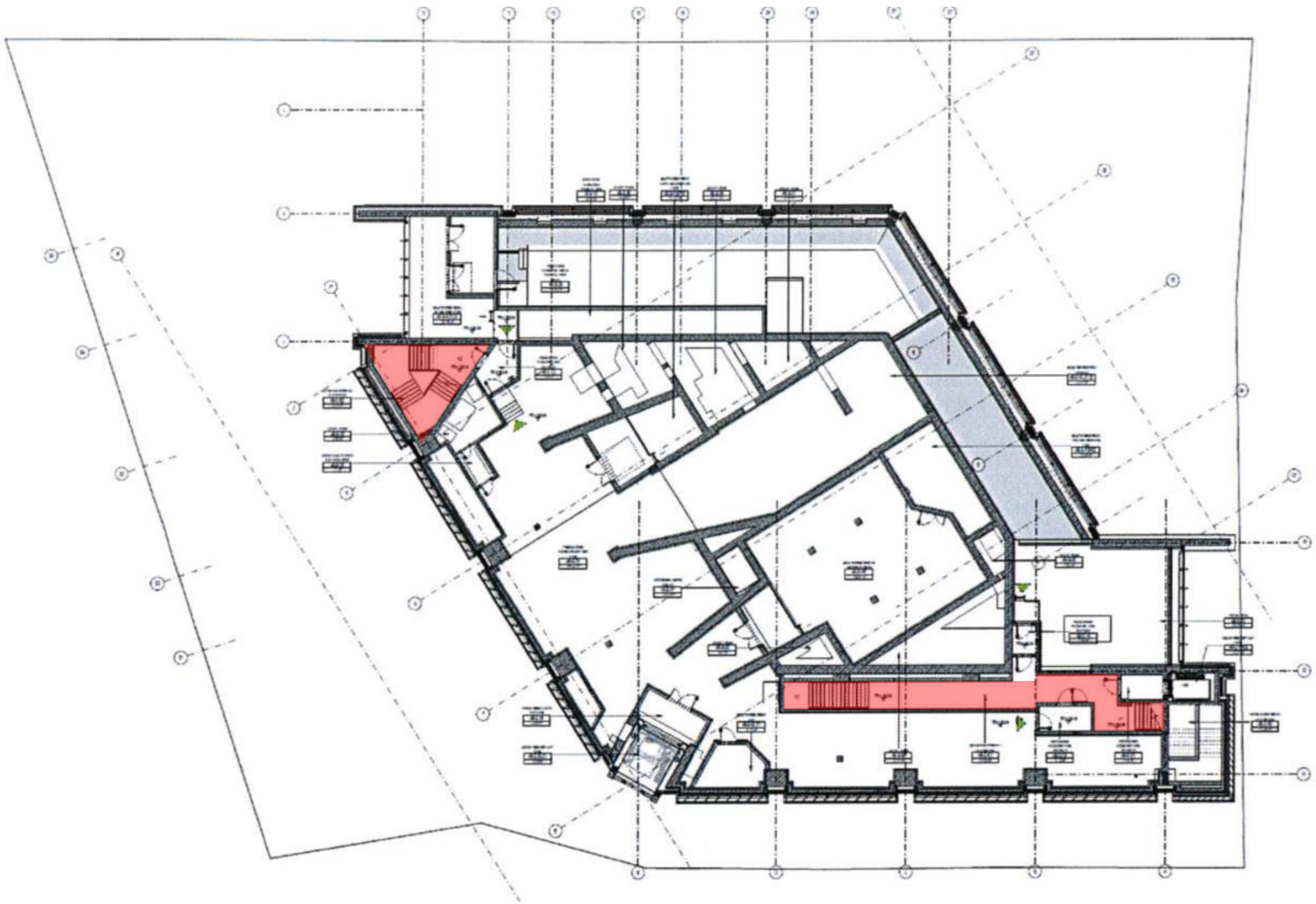
LEVEL 47



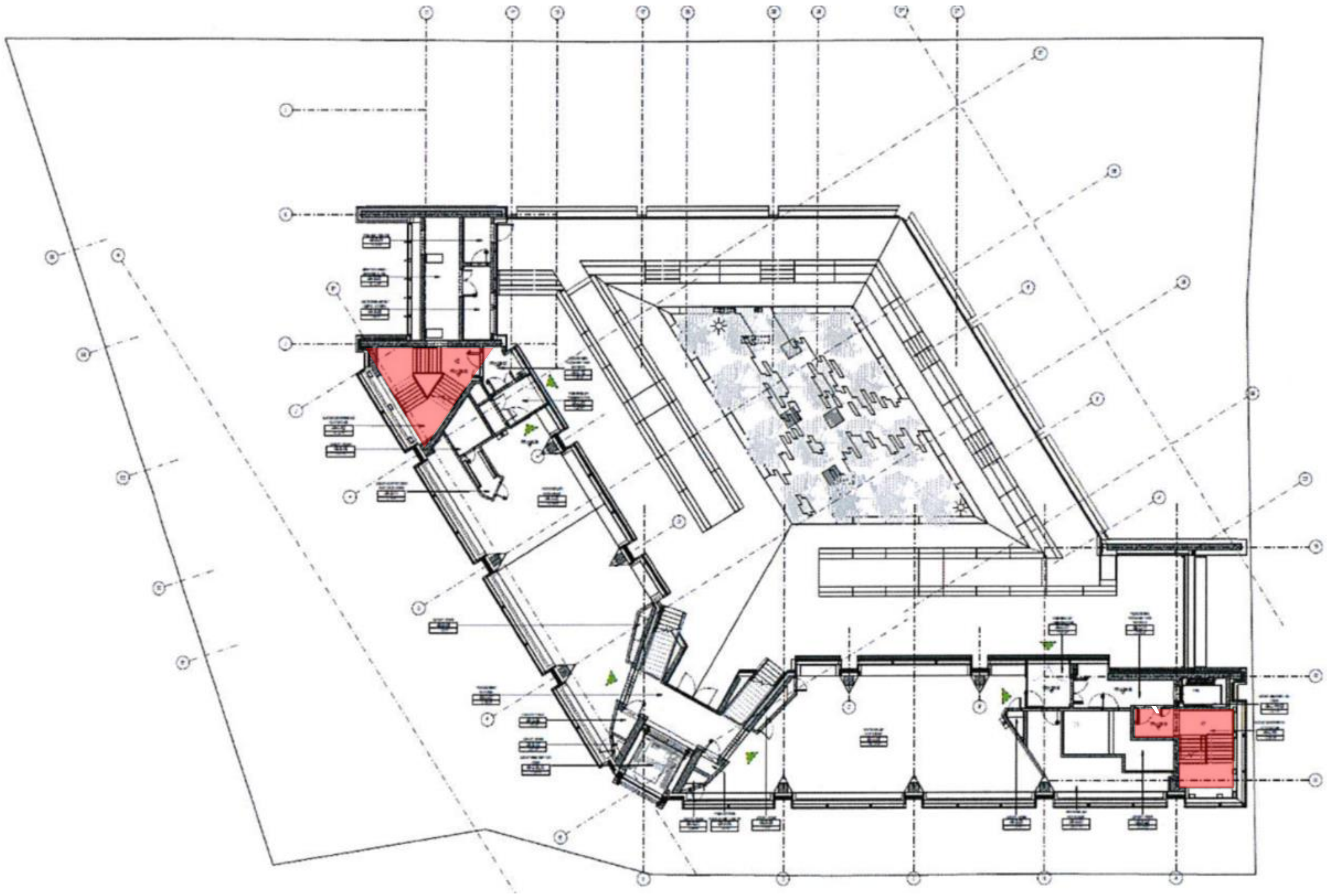
LEVEL 48



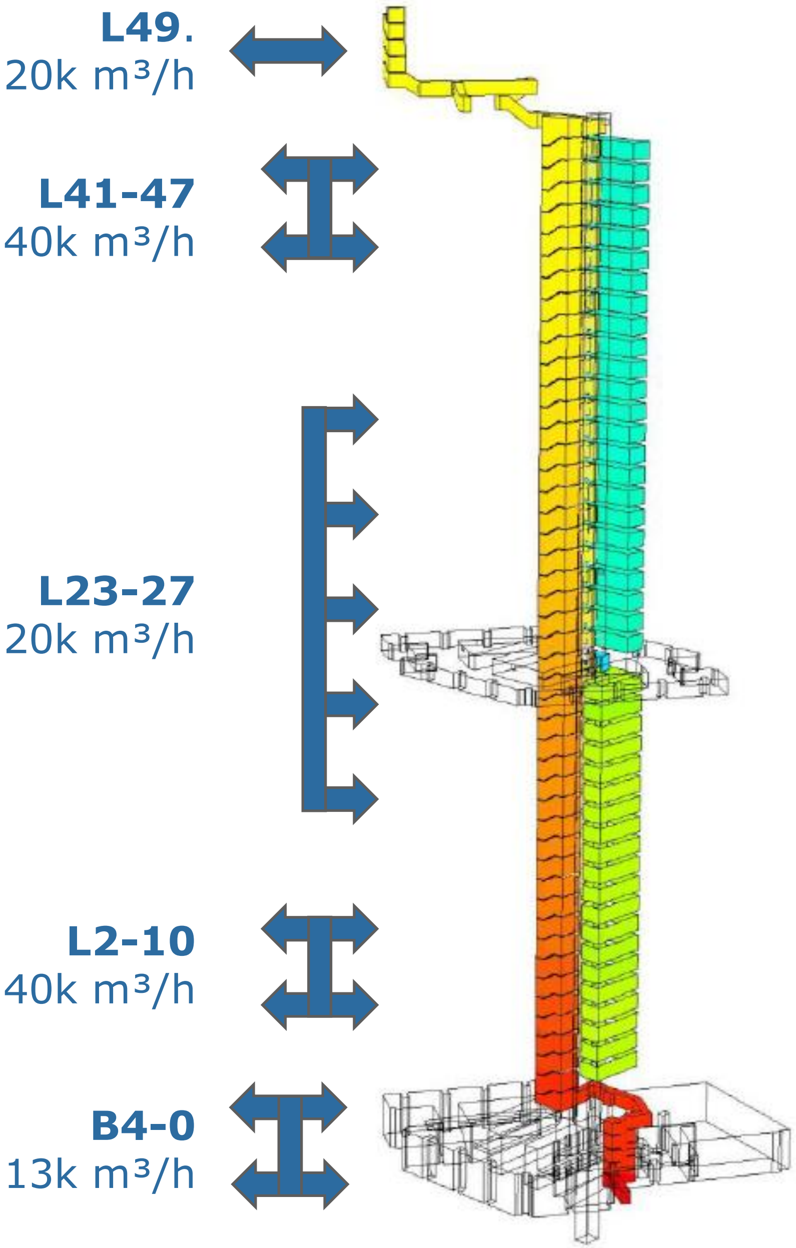
LEVEL 49

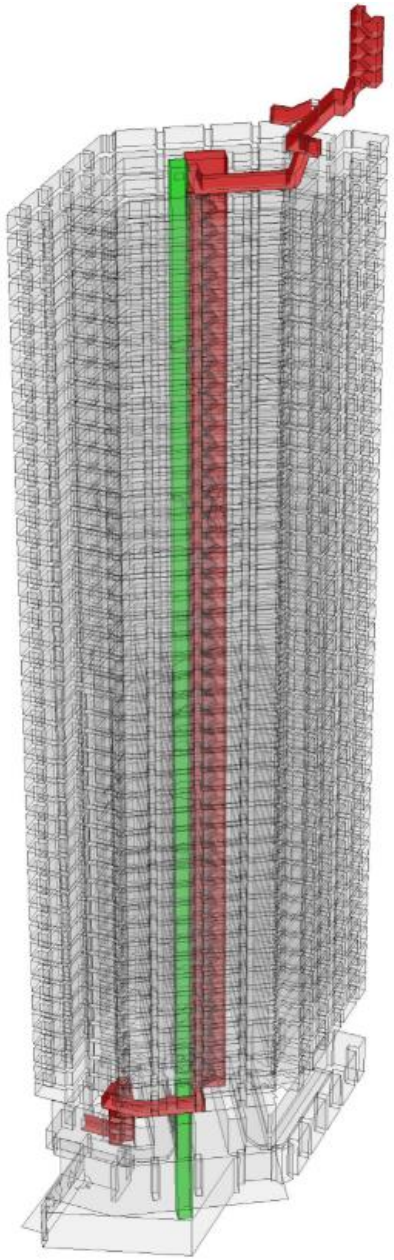


LEVEL 50




SOURCE: HB REAVIS

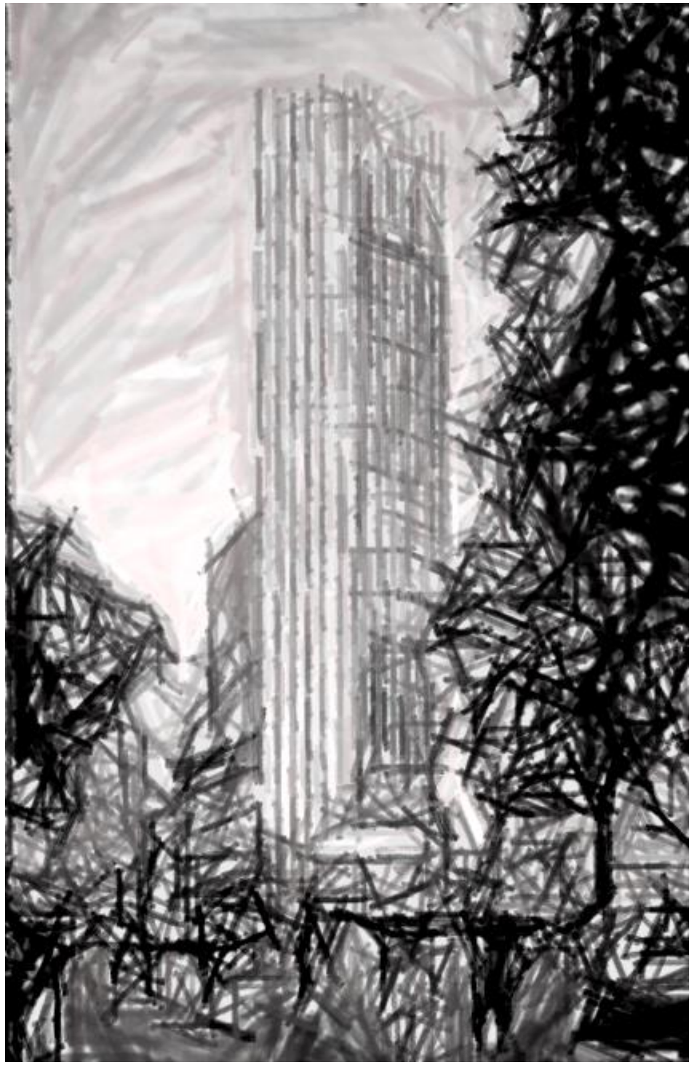

L49.
20k m³/h
L41-47
40k m³/h
L23-27
20k m³/h
L2-10
40k m³/h
B4-0
13k m³/h

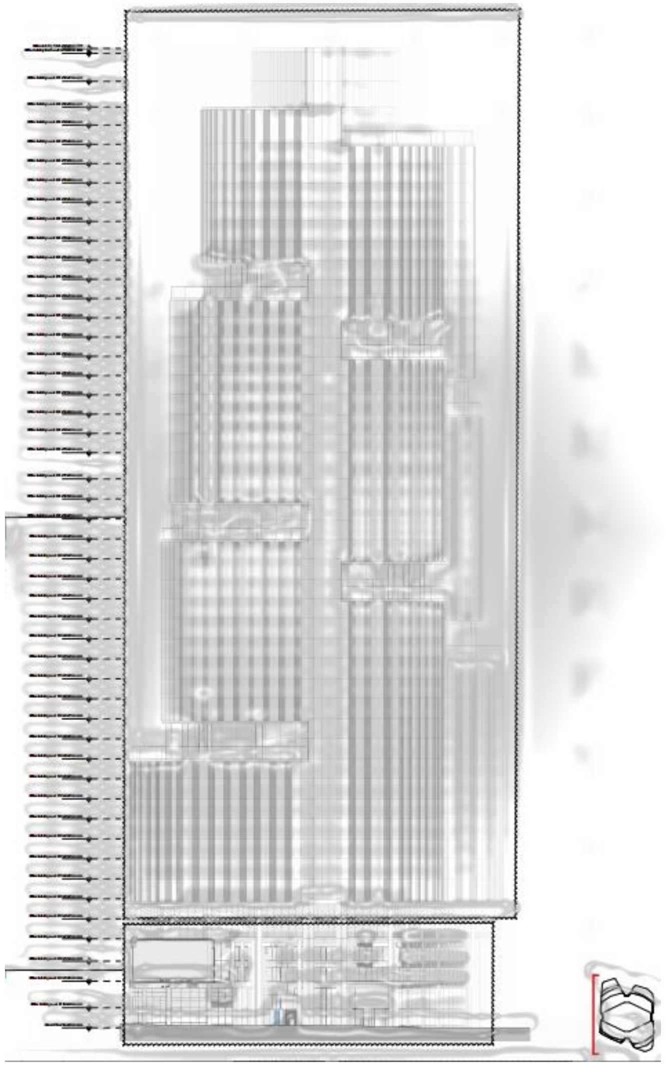


EXAMPLES OF RELIABLE **PDS in >60m**

PIRAEUS TOWER
GREECE
90m

MERCURY TOWER
MALTA
122m





>3 ONGOING PROJECTS
+150m IN LONDON

Tall Buildings Conference

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