

VENTILATION IN ENCLOSED CARPARKS



Santos Bendicho
Head of Smoke Control Projects Department
sbendicho@sodeca.com

VENTILATING IN ENCLOSED CARPARKS

1. GOALS OF THE VENTILATION
2. IMPULSE VENTILATION
3. DESIGN CRITERIA FOR IVS
4. EXAMPLES OF DESIGN
5. CONCLUSIONS



CO VENTILATION

- To keep controlled the concentration levels of CO & Nox.



SAFETY AGAINST EXPLOSION

- To dilute the flammable substances produced by cars, to concentrations below the (Low Explosion Limit)



VENTILATION IN CASE OF FIRE

- To have a system that allows the extraction or control of the smoke generated by a fire



IMPULSE VENTILATION

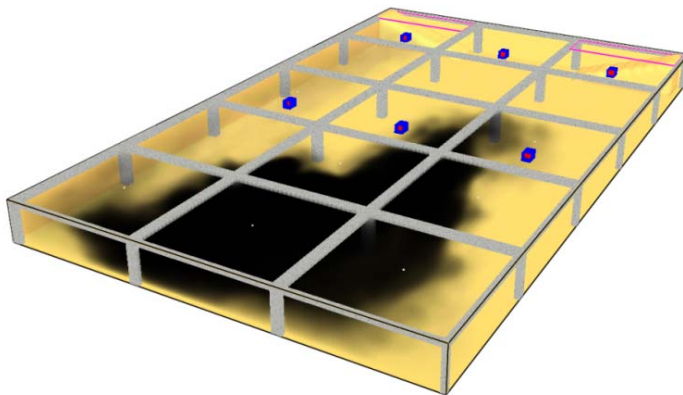




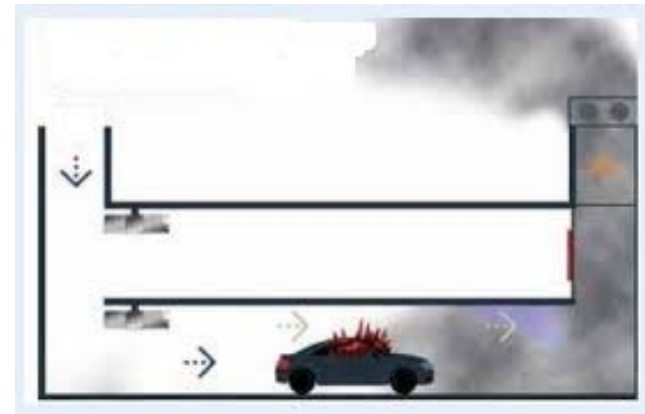
IMPULSE VENTILATION

This system is being used in all around Europe to ventilate underground parking, very large, with low ceilings and regular shape.

Smokeview 5.6 - Oct 29 2010



Frame: 230
Time: 715.2





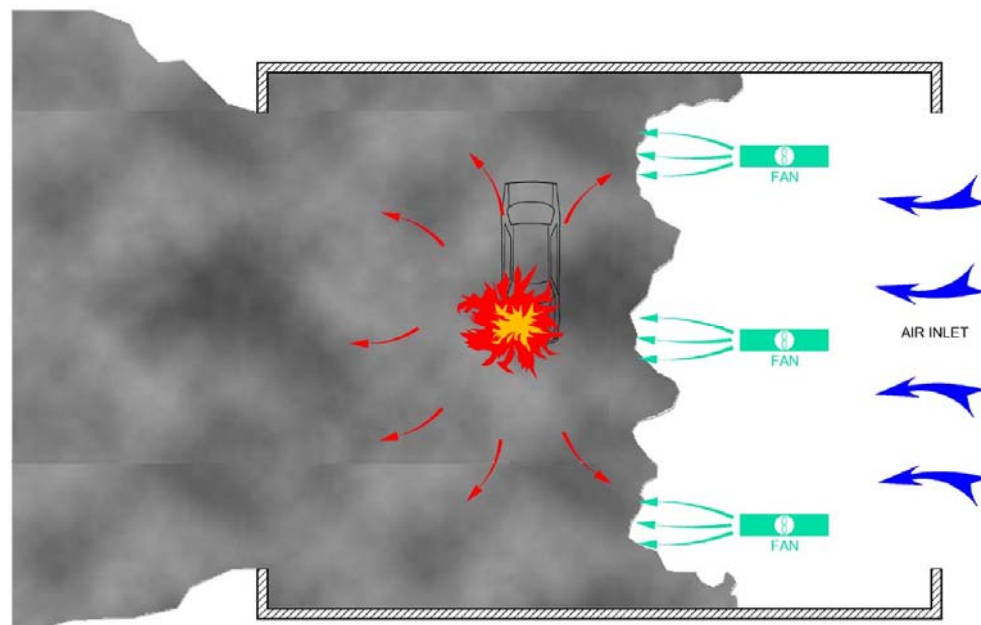
IMPULSE VENTILATION

The big difference with other systems is that ducting net are replaced for a matrix of jetfans or induction fans.

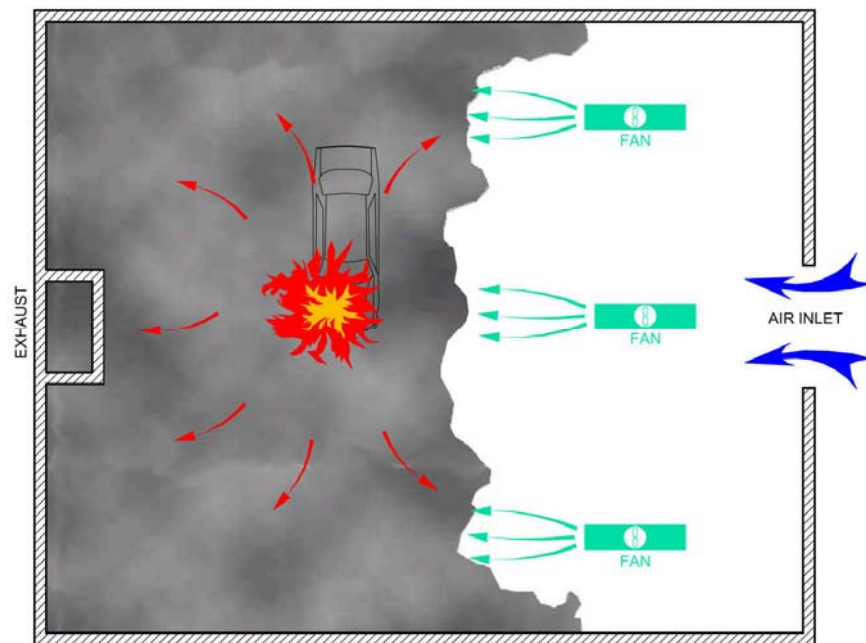


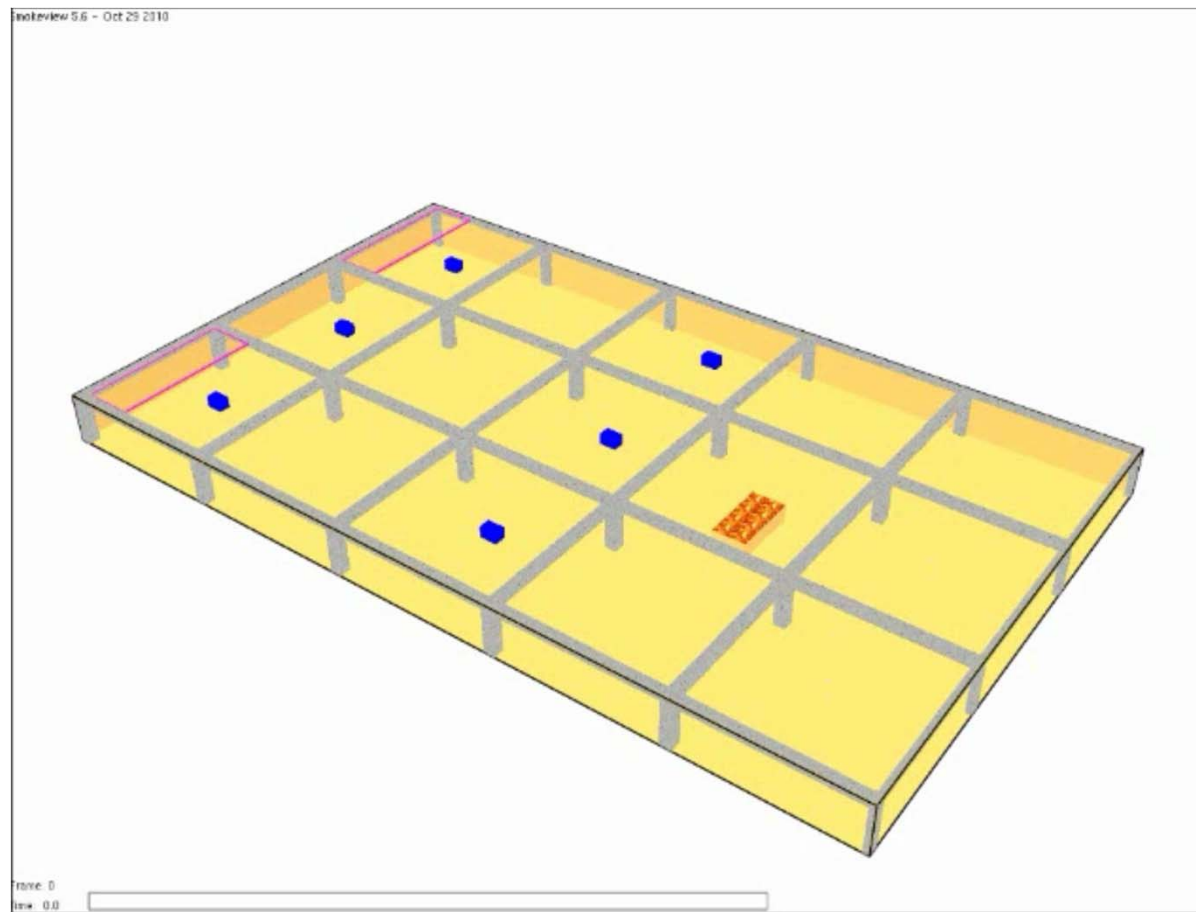
This system can be used in different cases:

In a natural ventilated carpark through facades, helping in the movement of air from one facade to the other, if the distance between them is too big.

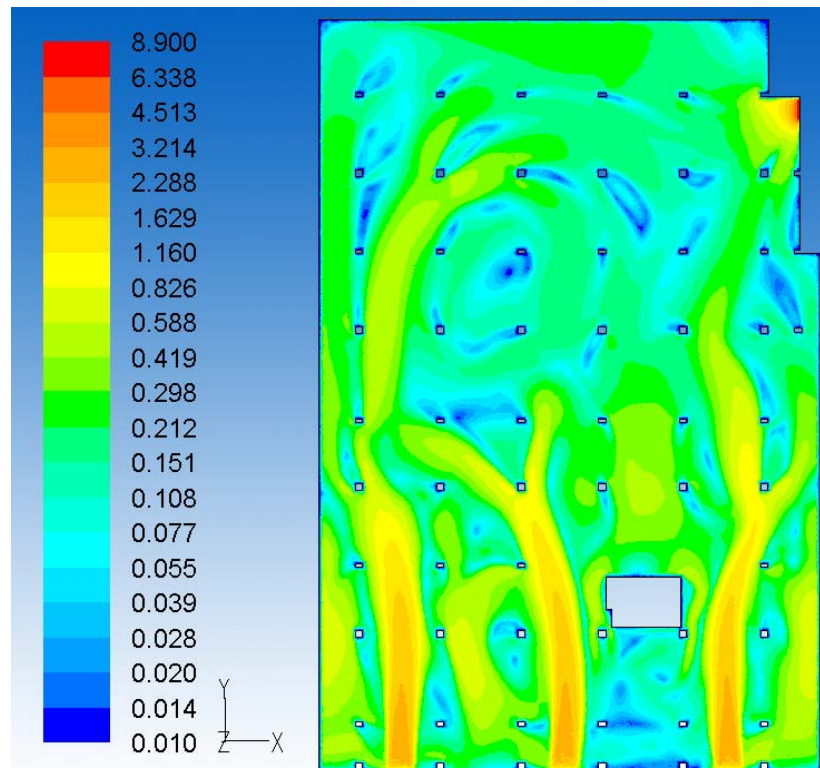


In a mechanical ventilated carpark, as an alternative to the ducting system.

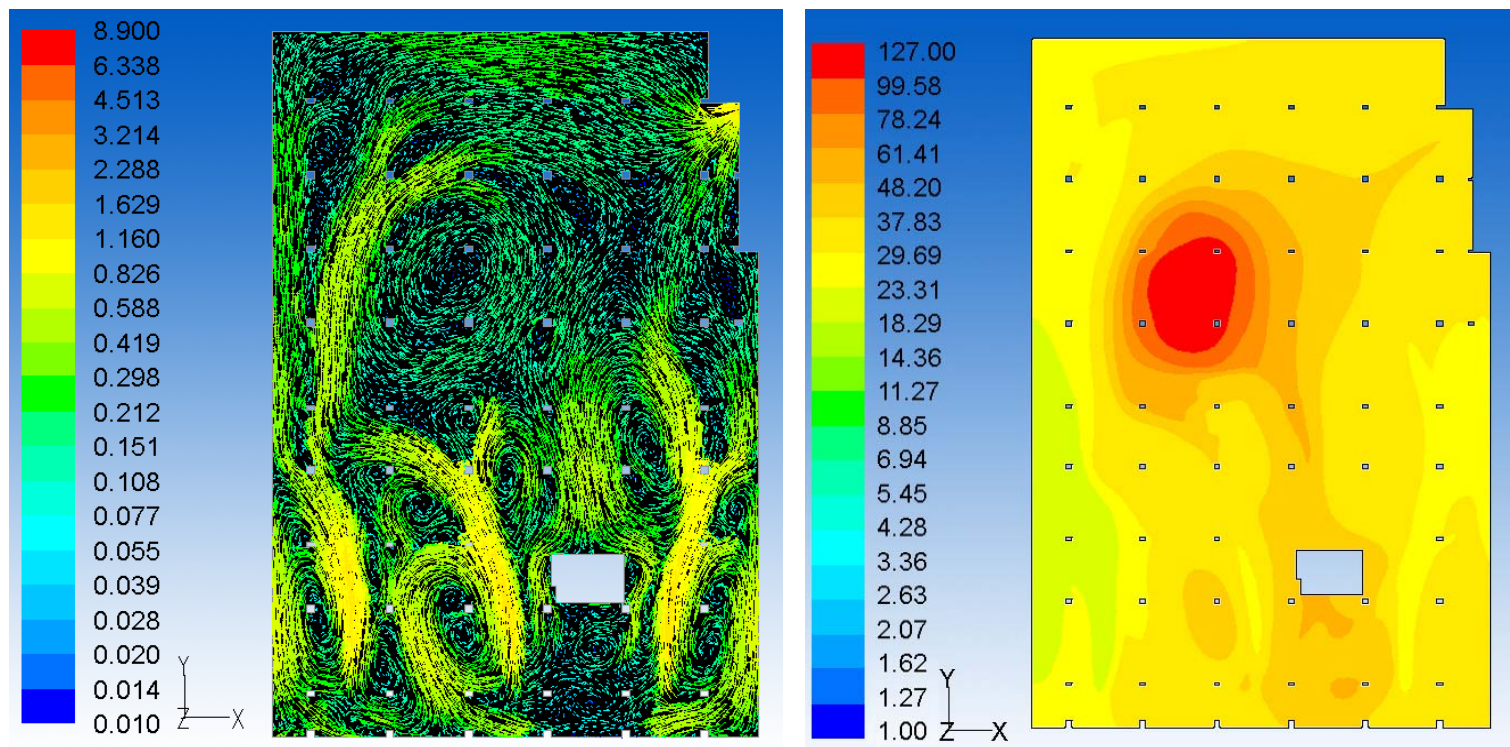




Inside a carpark the air movement through the storey is difficult because of the obstruction of cars and parts of the structure.



There is a tendency to create rapid flows in the lanes, and recirculation in the parking areas, and the pressure drop inside the carpark is considerable



This creates inefficient ventilation, recirculations, and “dead spots” or zones where there is no air movement.

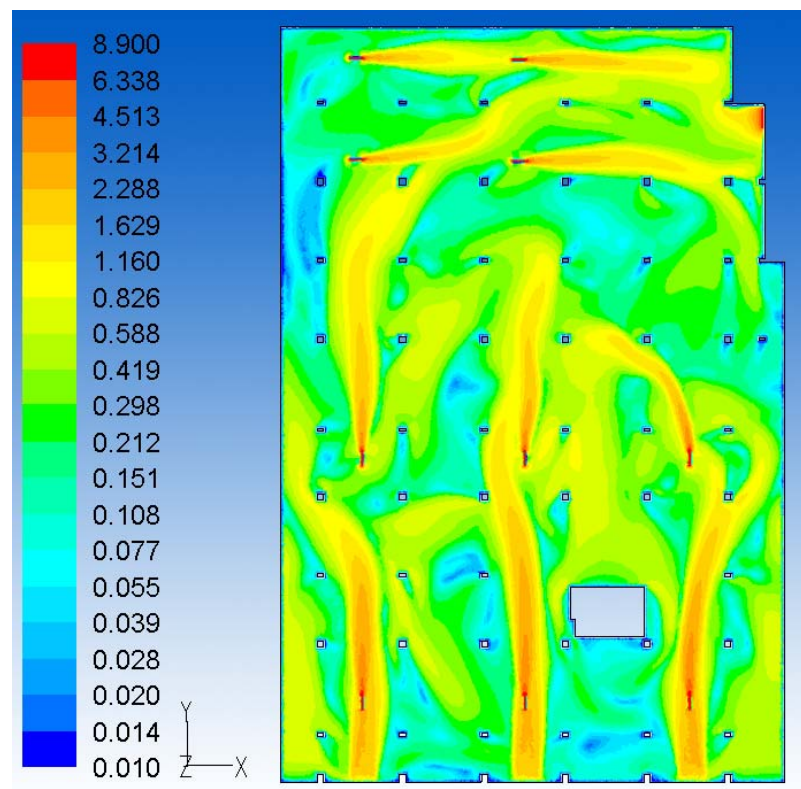


IMPULSE VENTILATION

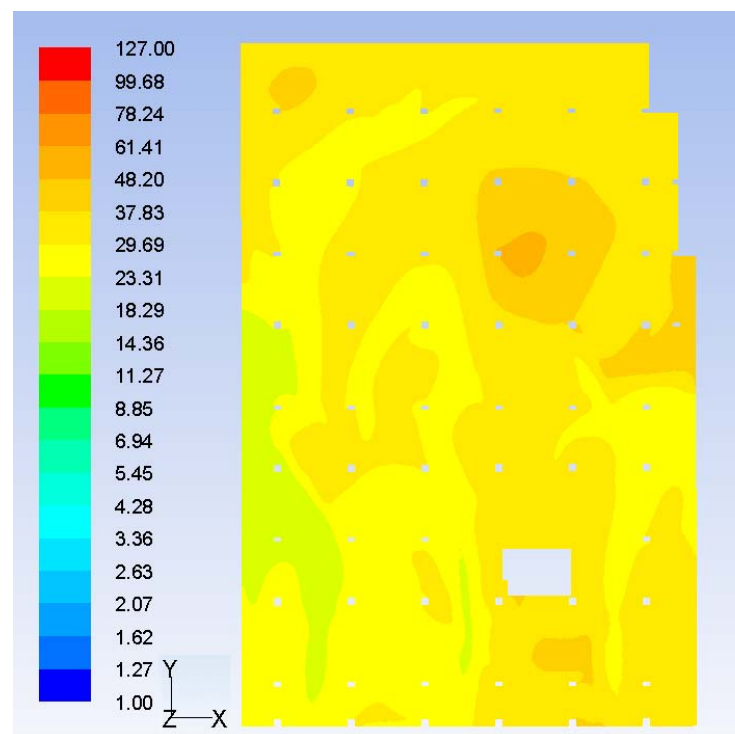
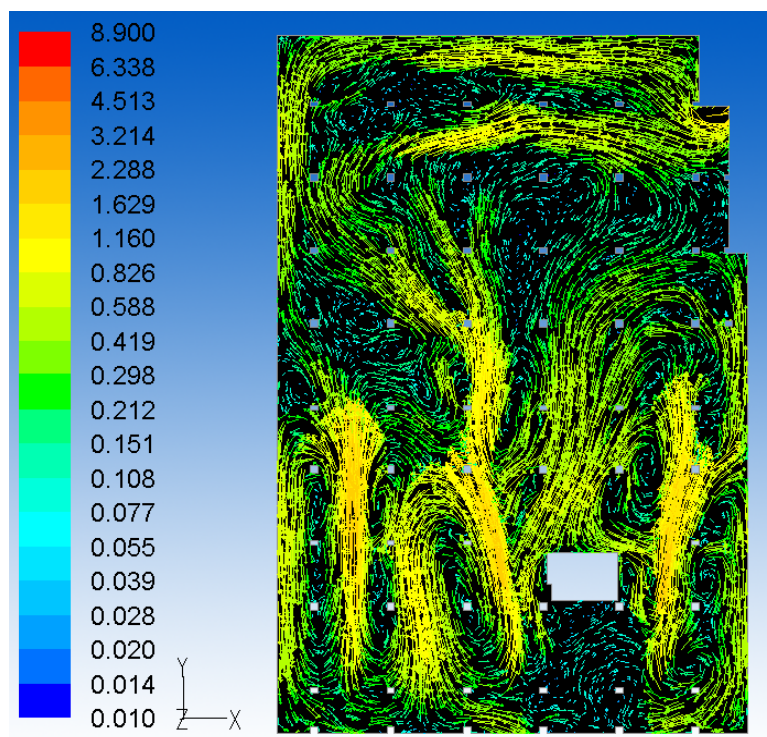
For this reason jetfans are installed in order to create an uniform flow, and overcome the inside pressure drop, reducing the static pressure neede for the extraction fans.



THT/IMP-C



This produces an uniform ambient in the basement without “dead spots”.



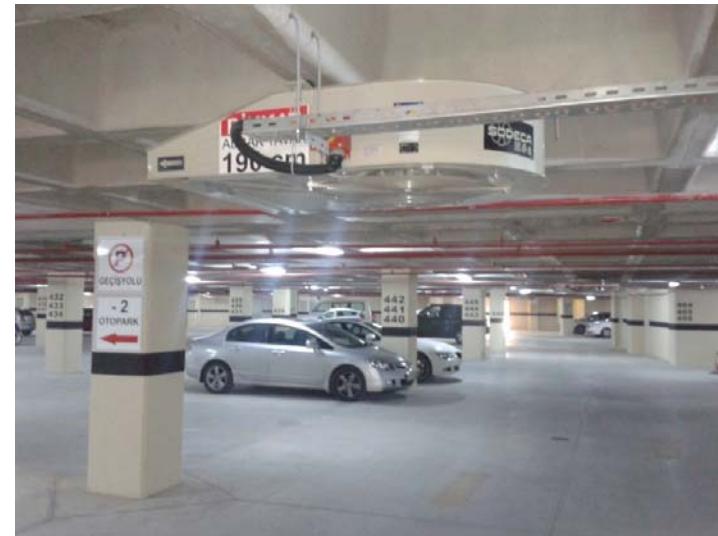


IMPULSE VENTILATION

Jetfans or induction fans are installed just under the ceiling.

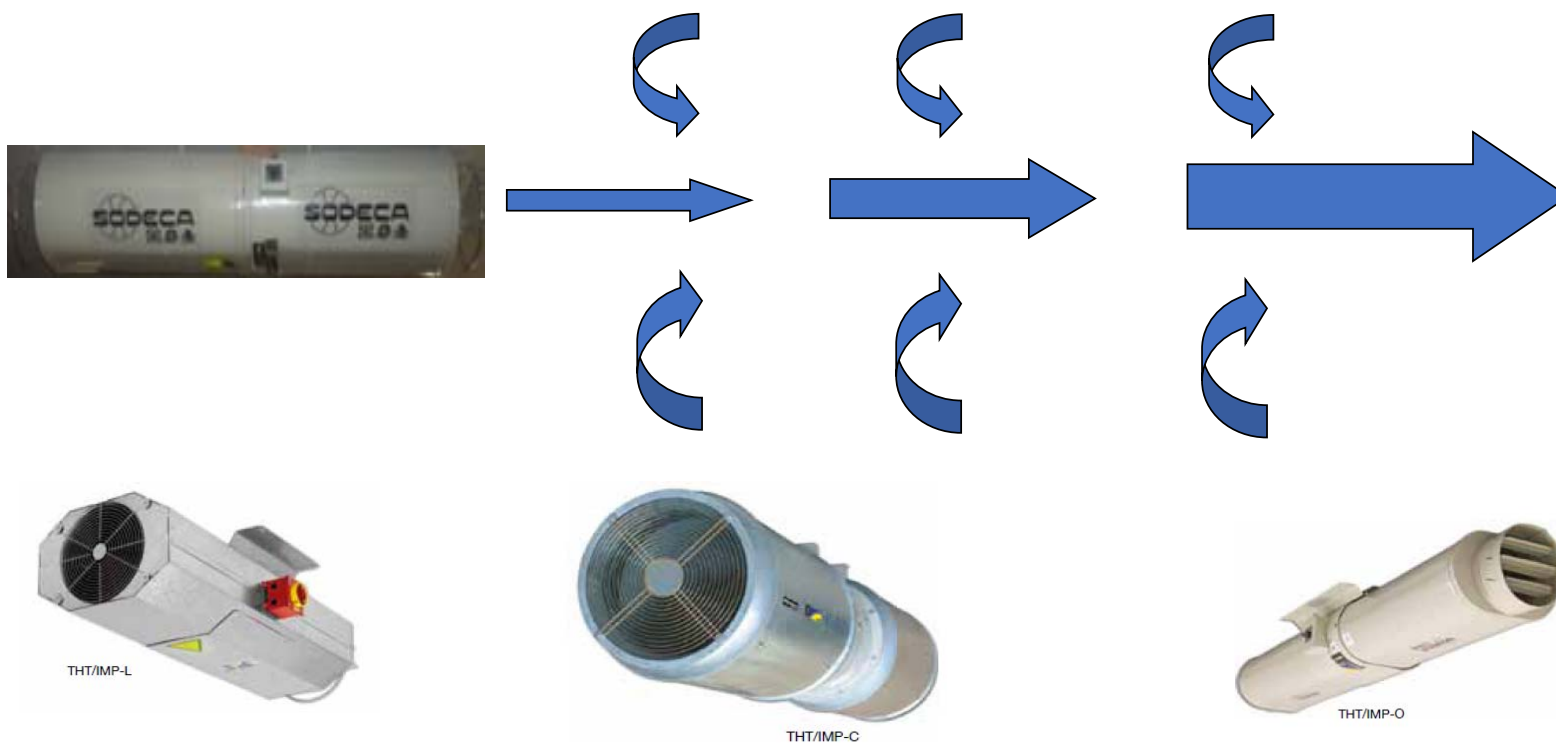
So a reduced high is required in order to allow the circulation of cars under them.

The impulsion of air is made downwards in order to avoid obstruction with the structure.

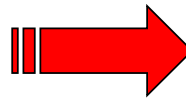


Jetfans

The impulsion of small volume of air at high speed, induces the movement of big volumes of air at low speed.



Smoke Clearance



Reduce the temperature and density and allow the fire fighters to extract the smoke during and after the fire.

Gives a number of air changes per hour, not taking in consideration the heat release and position of fire.

Smoke Control

Specifically designed to have a control in the movement of the smoke. Usually it requires a bigger and better extraction than the other systems.



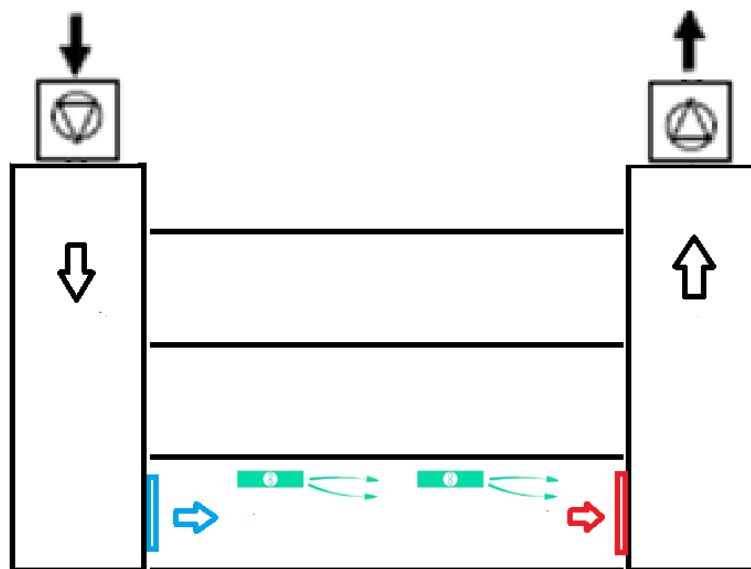
Can be designed for:

Help the evacuation of people and the access of fire fighters, creating bigger distances and zones free of smoke.

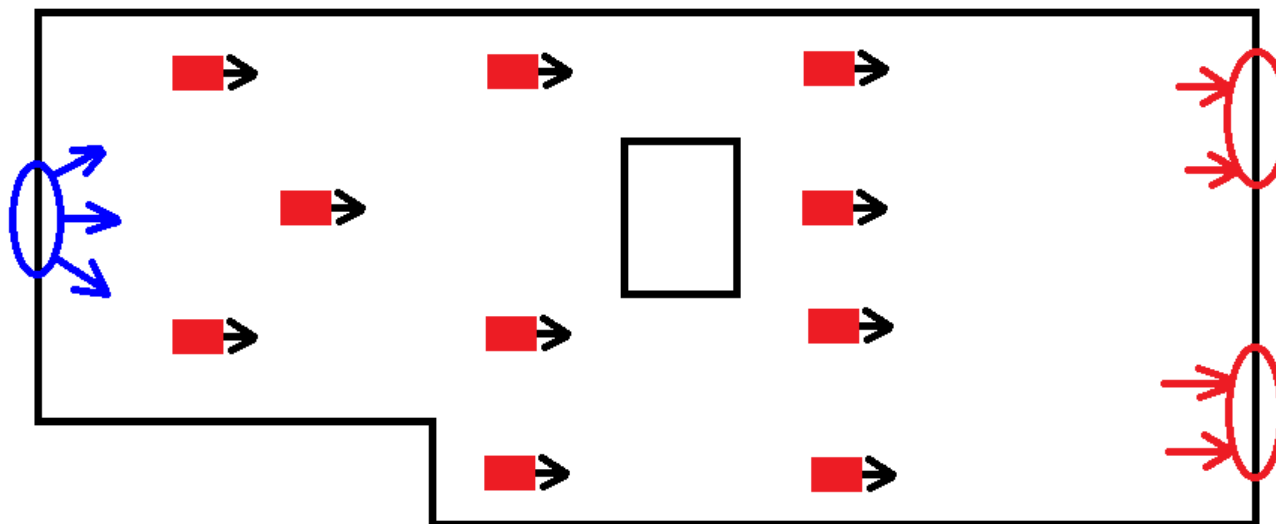
Help the fire fighting strategy as an alternative to sprinklers or fire compartments.

Mechanical ventilation assisted by impulse ventilation

The mechanical ventilation assisted by impulse ventilation is based on an extraction of air through extraction openings (coupled to extraction ducts equipped with mechanical extractors), reinforced by a horizontal air flow generated by the action of the impulse fans from the intake openings.



The intake and extraction openings should be arranged in such a way that cross ventilation is favored due to the action of the impulse fans. This system does not generally require the installation of additional ducts since the movement of the air can be carried out by means of the induction generated by said impulse fans.





DESIGN CRITERIA FOR IVS

BS-7346-7 consider a ventilation system that is capable of providing an exhaust flow rate of 10 renewals / hour of the volume of each one of the floors of the car park, or fire sector, served by said system.

The ventilation system must be activated by a fire detection and alarm system.

The detection system must locate the area where the fire started and alert the occupants to evacuate the parking lot.

A delay time since end of evacuation is required for activation of jetfans.

The ventilation system should be able to be activated and controlled by a system for the detection of polluting gases.



The system for detecting polluting gases must be equipped with carbon monoxide (CO) detectors.

Covering area (m² per detector) and high of installation should be indicated in national regulation.

BY MEANS OF 2 SPEED EXTRACTION FANS

CO LEVEL	EXTRACTION / SUPPLY	JETFANS
$15 \text{ ppm} \leq \text{CO} < 25 \text{ ppm}$	-----	(Low speed)
$25 \text{ ppm} \leq \text{CO} < 35 \text{ ppm}$	Low speed (50%)	Low speed
$\text{CO} \geq 35 \text{ ppm}$	High speed(100%)	Low speed

BY MEANS OF EXTRACTION FANS WITH INVERTER

CO LEVEL	EXTRACTION / SUPPLY	JETFANS
$15 \text{ ppm} \leq \text{CO} < 25 \text{ ppm}$	-----	(Low speed)
$25 \text{ ppm} \leq \text{CO} < 35 \text{ ppm}$	Proportional (50 – 100 %)	Low speed
$\text{CO} \geq 35 \text{ ppm}$	Maximum 100 %	Low speed



DESIGN CRITERIA FOR IVS

Ventilation control system

BOXPARK control panels in metal enclosure with all the necessary elements for the management and control of 2-speed fan or variable speed fans for smoke extraction, in installations with ducts or with impulse fans, in case of fire and control of CO levels in car parks. Control logic managed by PLC, fully programmable, easy to install and maintain.



Auxiliary panel for firefighters.

BOXPARK	-	M	-	2	-	20	-	S
↓		↓				↓		↓
Carpark control pannel		M: Master S: Slave		Total number of fans 2,3 o 4		Motor power (HP) from 1.5 to 10 * bigger powers on demand		S: 2 speed fans VSD: Inverter



EXAMPLES OF DESIGN OF IVS

Some tips for the design:

Define the position of the extraction wells and air supply ..

1. Air supply wells close to the evacuation routes, also considering the ramps.
2. Extraction wells in the area opposite the air supply wells.

Define the direction of the air sweep in relation to the position of the extraction and air supply wells.

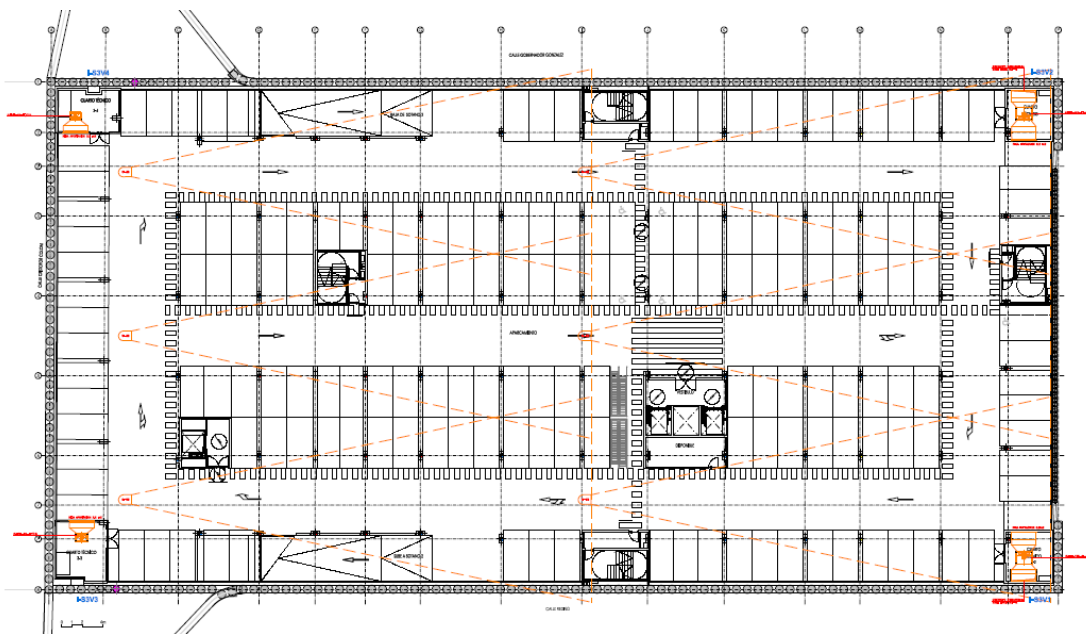
Create horizontal cross flow ventilation through the parking lot.

Need to have a regular speed, avoiding recirculation and considering the loss of pressure in the parking.

Divide the carpark area into different zones in some cases.

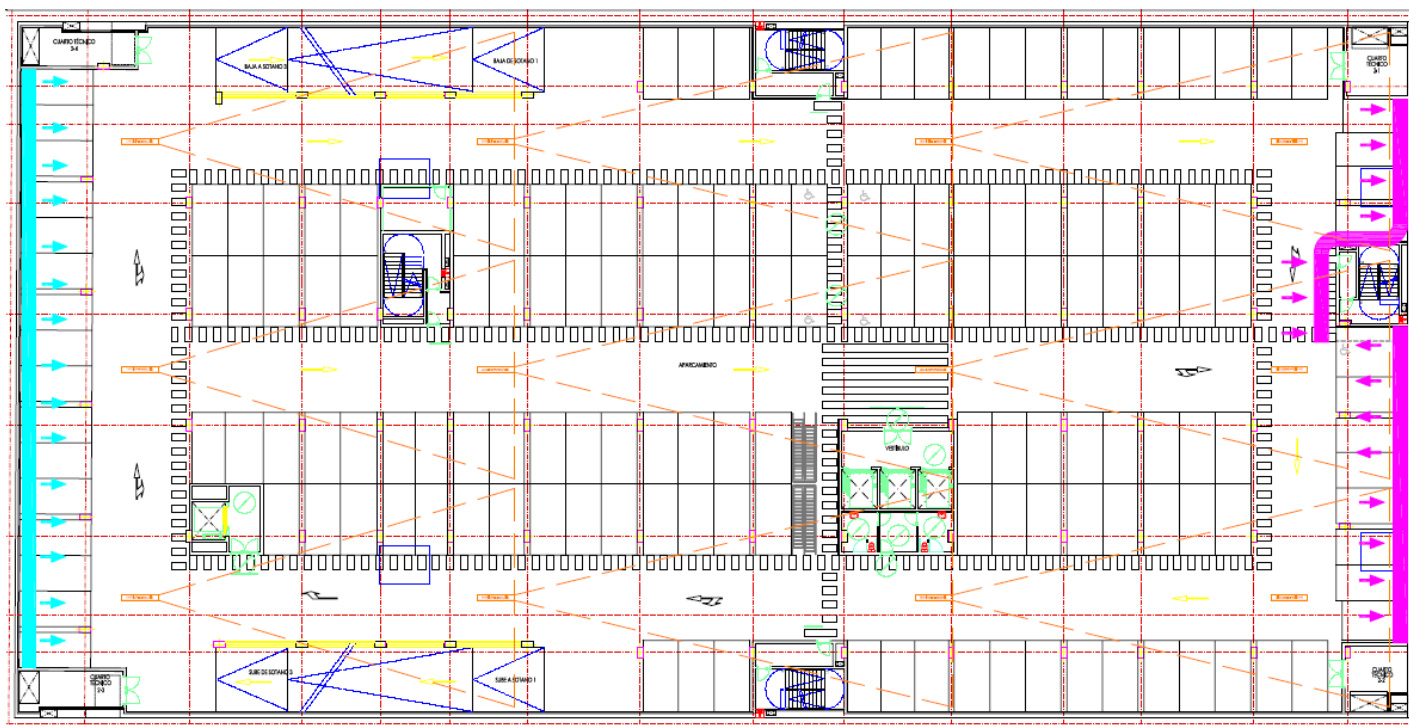
The Jetfans must be placed so that the opening of their dart covers the entire cross section of the car park.

It is advisable to locate the jetfans in the lanes, in order to avoid the interferences produced by the cars, and to minimize the risk of being on the fire.



The jetfans will be positioned for a velocity of the air vein between 0.5 and 1 m / s.

It is also possible to design reversible ventilation systems.





Benefits

More safety system.

Possibility to design “smoke control” system, that allows fire fighters to access inside the carpark.

Ambient in the carpark more healthy and uniform

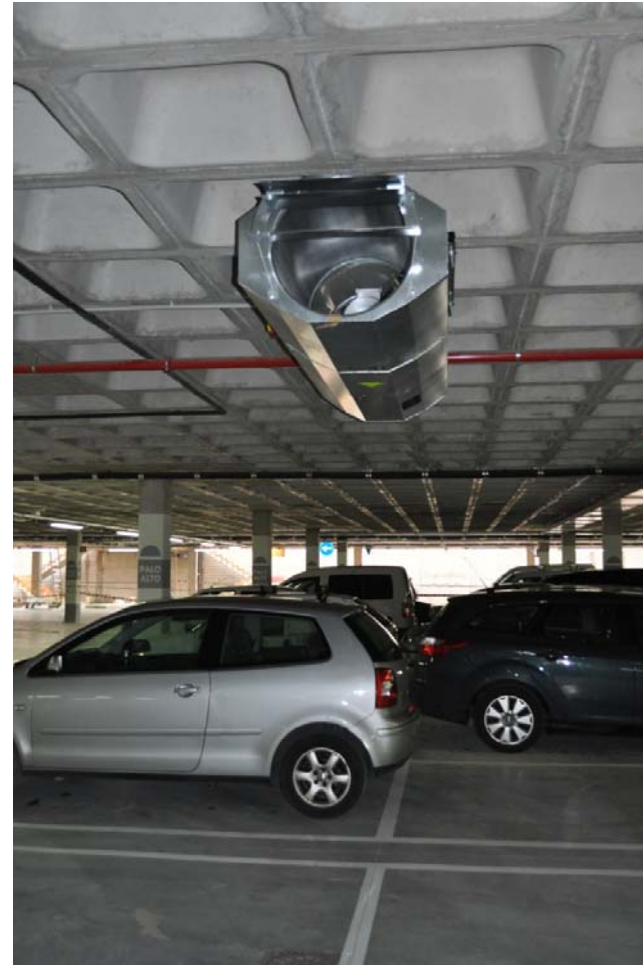
Ventilation for the dilution of CO avoiding not enough ventilated areas.

Easier installation, less assembly time and comissionning, less occupation of space below the roof, and better visibility in the carpark.

Less interferences with other installations (pipes, cables, ...)

Better conditions for the CCTV.







THANK YOU
FOR YOUR ATTENTION!



HEADQUARTERS
Sodeca, S.L.U.

Tel. +34 93 852 91 11
comercial@sodeca.com
www.sodeca.com