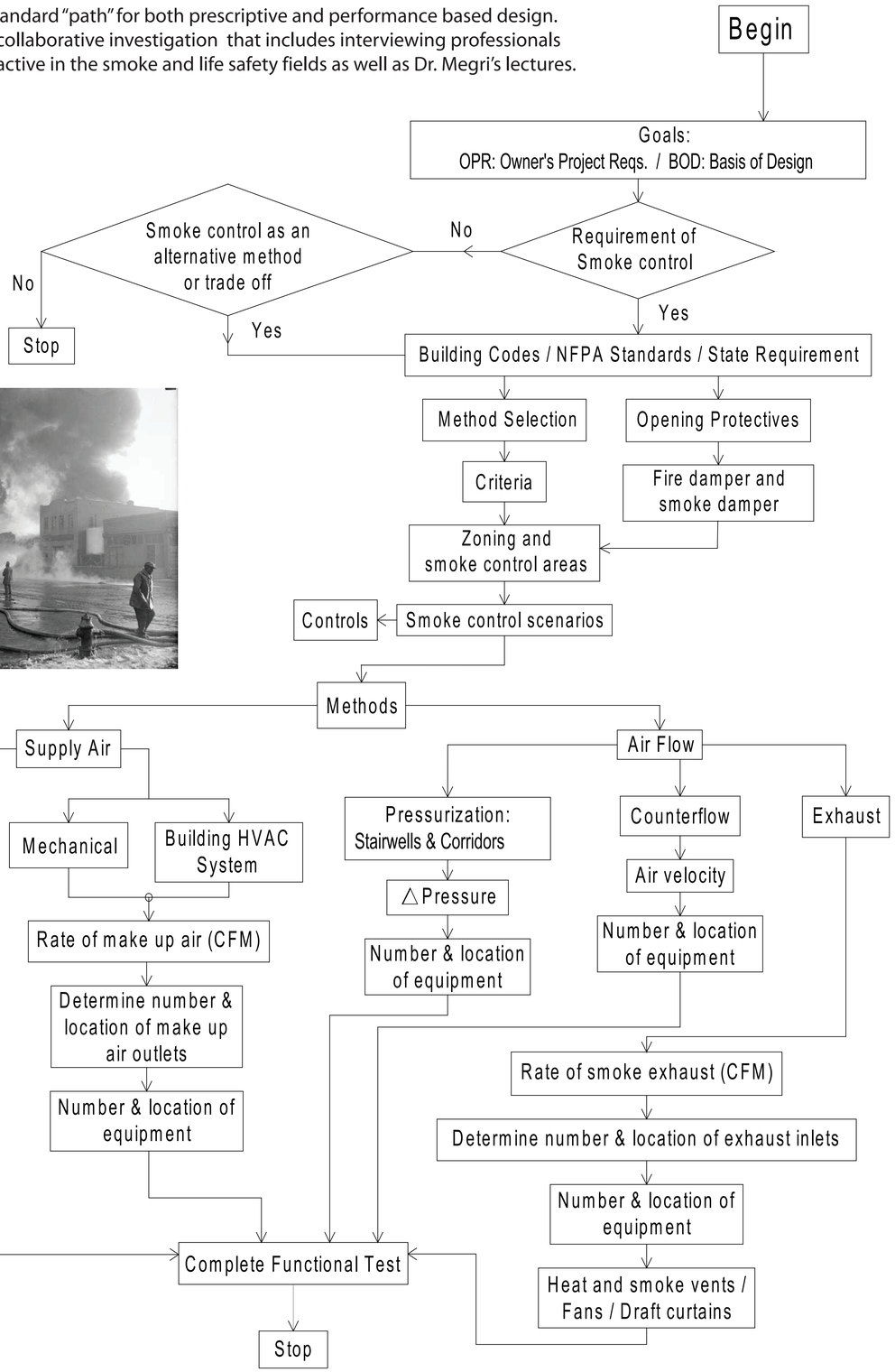
LIFE SAFETY AND SMOKE CONTROL

The following flow chart maps out the basic design process that is used when designing a smoke management system for various types of buildings. The smoke control design is a complicated process that involves building codes, science, engineering expertise in many fields, airflow in buildings, natural ventilation,fire and smoke dynamic, heat and mass transfer in building, etc.

This chart lays down a standard "path" for both prescriptive and performance based design. This chart is the fruit of collaborative investigation that includes interviewing professionals and researchers currently active in the smoke and life safety fields as well as Dr. Megri's lectures.



BACKGROUND AND GENERAL INFORMATION

history

Although fire has been around longer than humans, the idea of taking a public and proactive approach to its control or prevention is a fairly new one. Benjamin Franklin was the first to organize a fire department in 1736 in Philadelphia called the Union Fire Co. He later (1752) set up the first fire insurance company. These were the first efforts to limit, or control the damages caused by fire and smoke.

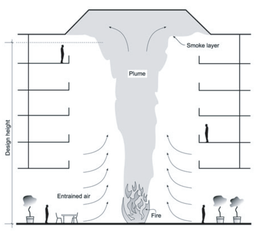
Much later, in 1871, the historic Great Chicago Fire destroyed much of the city's downtown area and created a new awareness of the power of fire in urban regions. It spawned new building codes requiring mostly brick and fire resistant building materials to be used in construction,thus transforming Chicago's image forever.

codes

Building and fire codes are sometimes referred to as "blood codes" because they are usually made in response to a tragedy like the Chicago fire. Although, they may come initially from catastrophic events, fire codes are periodically improved, to help keep buildings safe for longer even in the most unforeseen situations.

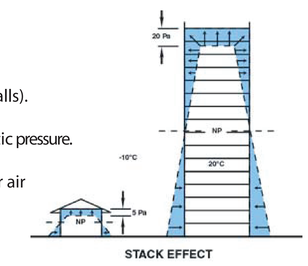
When designing a smoke control system there are a lot of things to consider. The code can be very vague, but it does point out several methods to use when designing. The pressurization method is the most used for stairways and exit zones. This is because the higher pressures in these emergency regions helps to keep smoke from flowing into them, and thus clear people's paths out of the building.

concepts



In large volumes such as atriums the exhaust method is often used. This process removes the smoky air from the top of the space, while replacing it with clean air from the base. The clean (make up) air can be mechanically or passively added to the space depending on the specific requirements outlined in the job.

In high rise buildings large pressure differences between the indoors and outdoors develop. This is known as the stack effect. As a consequence air moves through openings (doorways, cracks in the walls). This air movement is reversed above the neutral axis because of hydrostatic pressure. In larger buildings these pressure differences can be very important for air and smoke movement within the building and therefore shoud be considered when designing an HVAC and smoke control system.



STACK EFFECT

CASE STUDY
The McCormick Place West Building

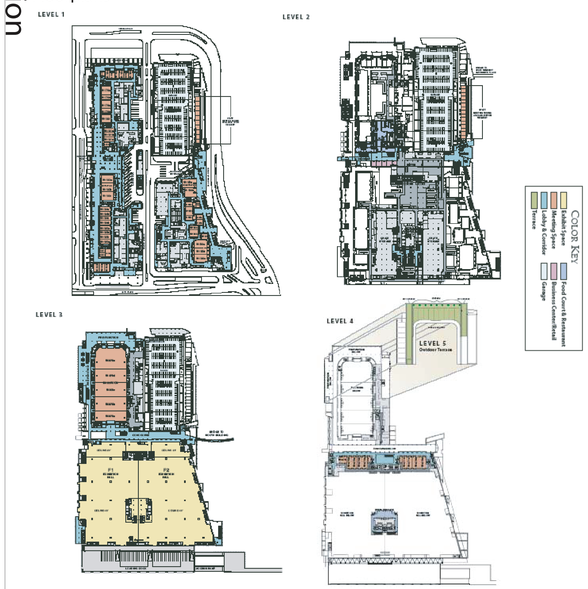
general information

Location: Chicago, IL

Description: McCormick Place West Building, when completed will constitute the largest convention center in the United States.

Quick Facts:
- 470,000 square feet of exhibition space
- 250,000 square feet of meeting space
- 100,000 square feet of ballroom
- 180 feet span between columns in ballroom
- 61 meeting rooms
- 40 feet average height in ballroom
- 5 levels in building

Floorplans



description

The McCormick Place smoke control system is integrated with the HVAC system. The building area is divided to a certain number of zones. Each zone is served by a number of air handling units. In case of fire, the air handling units of the area affected will switch to exhaust mode in order to keep the egress space free from smoke for the time of evacuation.

A major problem when designing the fire protection systems for the Ballroom, where a set of fake ceiling panels were placed approximately 15 ft. below the actual ceiling. By code, the sprinkler system had to be placed within these panels, which have large holes for aesthetic reasons. The problem was that in case of a fire the heat would pass through the holes in panels and the sprinkler system would not be activated. The solution presented was to cover the holes with Plexiglas® panels which would trap the heat but would not affect the aesthetics.

Within the atrium portion of the building, the height of the ceiling presented quite a challenge for designers. Due to the inefficiency of traditional smoke detectors, laser beam smoke detectors were used. These detectors were comprised of two parts, the beam transmitter and receiver. In case a fire broke out, the created smoke would interfere with the laser beam transmission and trigger the alarm devices and sprinklers in that zone.

In the main exhibition hall, due to a large amount of space that needed to be controlled, a combination of draft curtains and ceiling smoke and heat vents were used. The draft curtains act as a physical barrier that contains and directs smoke flow in the event of a fire, while the vents exhaust the smoke out of the building.