

## Case Study: Citigroup Finds Efficiency in Direct Outside Air System (DOAS) Solutions

### CHALLENGE

When Citigroup decided to remain at 388/390 Greenwich Street as their 2.7 million sq.ft. corporate headquarters, this worldwide financial giant created a new corporate vision. As part of this vision, Citigroup's leaders challenged the design team to create the best environment possible for their people, including:

- Energy efficiency for a LEED Gold CI Rating
- Better ventilation and temperature control for the occupants
- Cost-effective solutions
- Higher ceilings
- Upgrades to aging infrastructure

The MEP team's focus soon zeroed in on the development of a high-performance system to achieve this goal. Adding to the project's complexity, Citigroup charged the design team with bringing this vision to fruition on a phased, floor-by-floor basis in an active, occupied building.

### ALTERNATIVES CONSIDERED

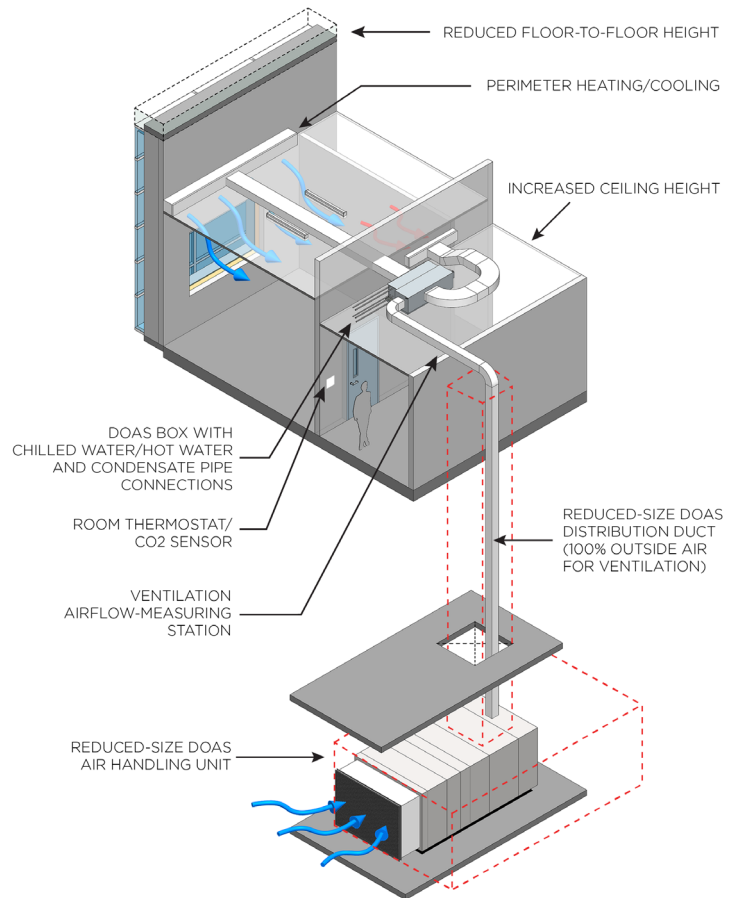
As part of the team's due diligence in addressing this challenge, traditional HVAC solutions as well as new/innovative HVAC solutions were pursued.

- Traditional variable air volume (VAV) system (to match their existing system)
- Fan-powered VAV system
- Chilled beam system
- Direct outside air system (DOAS)

After detailed technical and cost analyses, Citigroup decided to embrace the innovative DOAS solution for their typical office space environment.

### WHAT IS DOAS?

DOAS combines the traditional cooling/heating benefits of a fan coil unit with the precise primary airflow capabilities of a VAV box. This system provides cooling control and ventilation on an occupant point-of-use basis in lieu of the traditional variable air/constant temperature approach found in a traditional VAV blended ventilation air model. Simply put, a DOAS system can deliver all required outdoor air to each occupied space independently or in conjunction with local terminal HVAC units.



### BENEFITS OF ACHIEVING CITIGROUP'S VISION

- **Space Savings.** The DOAS required 75% smaller medium-pressure ductwork.
- **Space Savings, Part 2.** The local floor air handling unit is also 75% smaller due to the need for precooling of ventilation air only. (Provides dehumidification component.)
- **Green Building.** Contributes to several LEED points.
- **Energy Efficiency.** Chilled water at the DOAS box is more efficient than all-air VAV. Variable speed fan control and chilled water setback controls also add to energy savings.
- **Improved Air Quality.** Space thermostats also measure CO2 levels. Primary air varies from an upper limit of 20 cfm/person to 30% greater than ASHRAE 62.1 for better occupant ventilation.
- **Ventilation Distributed as Needed.** Point-of-use ventilation for general office space as well as periodic high-occupancy spaces such as conference rooms.
- **Little Disruption to Operations.** All work was performed on a floor-by-floor basis, thus allowing Citigroup to maintain occupancy in the building.