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70 Light Square Case Study — Renovation with Active Chilled Beams & Low Temperature VAV System

Overview

The 70 Light Square project was a renovation of a 5 story multi-tenant office building in Adelaide, Australia. The building had a constant volume-variable temperature system served by separate air handlers on each floor and a central chiller. Each of the floors had approximately 7,500 sq. ft. of rentable area (37,500 sq. ft. total)

Over time the building's cooling loads had increased due to higher equipment heat gains and occupancies. Another problem was the lack of adequate air circulation rates, particularly in the center zones. (The total supply airflow circulation rate at design averaged 0.65 CFM/sq. ft.).

The existing air handlers were not capable of delivering the higher capacities to the interior zones. In addition the owner wanted a more efficient system with lower operating costs.

System Design Issues

- The design team objective was to achieve the energy efficiency targets for a GBCA Green Star certification (Australia's equivalent to LEED certification as administered in the US by the USGBC).
- There was insufficient refrigeration and pumping capacity to satisfy the new cooling loads which required installation of a new chiller and pumps..
- The primary airflow was limited by the existing central air handlers and ductwork, and an important design objective was to use much of the existing ductwork.
- The existing system utilized a primary air temperature of 59 ºF.
- Space above the suspended ceiling was adequate to accommodate ceiling-mounted units.
- The design needed to provide the ability to operate each floor's HVAC system independently from the others.

Active Chilled Beams and Inffusers

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Design Solution

Dadanco was able to offer a new lower temperature VAV interior system design and active chilled beam perimeter system design that met the design objectives.

- New central air handers were installed—one serving the perimeter zones and one serving the interior zones on each floor.
- Primary air temperature was set at 55 °F (20 °F ΔT) as opposed to 59 °F (16 °F ΔT) utilized in the existing system.

Interior System

- Primary air was ducted to each VAV terminal and Inffuser. The primary air remained the same as the original design. With the lower primary air temperature the cooling capacities in the interior zones were increased 25%.
- (91) IDL linear 2-way discharge Inffusers™ were used to distribute the air from the single duct VAV terminal units. Secondary room air was induced into the Inffuser from the return air ceiling plenum and mixed with the cold primary air. The tempered mixed supply air was then delivered to the zones.
- While primary airflow to the interior zones remained 3,200 CFM per floor, the secondary induced room air was over 3,000 CFM. The total tempered supply air delivered to the interior zones was increased to over 6,200 CFM effectively doubling the supply air circulation rate.
- The supply air in the interior zones was delivered at a constant 66 °F temperature throughout the VAV terminals modulation range as the induction ratio remains constant alleviating any concerns about cold drafts or dumping..

Perimeter System

- (118) ACB50 1-way discharge Active Chilled Beams were installed in the perimeter zones.
- Secondary water was piped and primary air ducted to each active chilled beam. The primary air temperature and secondary water chilled water temperatures were set at 54 °F.
- The primary airflows in the perimeter zones were decreased significantly as the active chilled beam's water coil provided most of the sensible cooling capacity.

Benefits

- Cooling capacities were increased by 25% in the interior zones, with no change in primary airflows or fan energy consumption.
- Fan power consumption was reduced significantly in the perimeter zones, while still providing higher cooling capacities.
- Each floor's air handling system could be operated independently of the other floors.

260 North Elm Street Westfield, MA 01085
Ph: (413) 564 — 5657
Fax: (413) 568 — 5384

www.dadanco.com
info@dadanco.com