Neal Smith Federal Building
Mechanical and Electrical Upgrades
Des Moines, Iowa
ASHRAE Technology Award Application

KJWW #07.0202.27
March 12, 2015

General Building Information

Project size: 390,000 gross ft^2

Budget: $30,500,000

Completion: 2012

Space Use: Offices, cubicle work spaces, conference rooms, café, restrooms, and storage/mechanical

Project Background

The Neal Smith Federal Building, located in Des Moines, Iowa, was built in the mid-1960s. A new high-performance envelope was later installed in 2004. The 390,000-square-foot office building provides tenant space to numerous federal agencies. American Recovery and Reinvestment Act (ARRA) funds were allocated to the building with the goal of upgrading its outdated infrastructure with focus on high-performance, energy-efficient design. The scope of the project upgrades the majority of the building's MEP infrastructure with energy-efficient systems and addresses many deferred maintenance items.

Energy Efficiency

An array of energy-efficient design strategies was implemented as part of the project in an effort to reduce the building's overall energy footprint. The following upgrades were incorporated:

a. The building's four main air handling units (AHUs) were converted from dual duct to variable air volume operation.
b. A decoupled, demand-based ventilation system was implemented and is controlled based on building occupancy. Dedicated outside air units (DOAUs) with energy recovery were installed at the penthouse level. These DOAUs utilize exhaust air from the building's two restroom group stacks to precondition ventilation air. Installation of this dedicated ventilation system allows the large main AHUs to operate as cooling-only and bring in ventilation air only during economizer mode.
c. High-velocity induction units around the building's perimeter were replaced with radiant heat. Replacement of the high-pressure duct system serving the induction units substantially reduced fan energy in the building.
d. New electronic-based HVAC controls were installed in lieu of the previous pneumatic building automation controls. Optimized control strategies were implemented for all building systems.
e. The central chilled water plant was converted from constant speed to variable speed chilled water pumping in a variable primary configuration.
f. Overhead lighting controls were added to vary light levels based on occupancy and daylight for perimeter spaces. The overall lighting power density was reduced building-wide. Light levels were dramatically reduced from 60 foot-candles to 30 foot-candles (augmented with task lights).
g. All of the building's outdated transformers were replaced with new energy-efficient transformers.

Energy metering was installed for all building utilities and has been monitored since project completion. Overall, the total building energy use has dropped nearly 40 percent. Prior to the ARRA project, the building was using

approximately 75 kBtu/sf on average and is currently operating at around 45 kBtu/sf annually. The building has since become Energy Star certified.

Indoor Air Quality

ASHRAE 62.1-2007 was used as the basis for determining the amount of required outside air for space ventilation. Outside air is ducted directly to the occupied spaces, immediately downstream of each temperature control terminal air box, after it has been filtered and conditioned. Densely occupied spaces have dedicated terminal air boxes to shut off ventilation air when the spaces are not being occupied.

Innovation

The new HVAC system concept was able to be effectively integrated into the framework of the existing building. The two AHUs which previously served perimeter induction units were replaced with new DOAUs; the existing induction unit duct risers were reused for the DOAU ventilation system air distribution; the heating water system which served induction unit hot water coils was repurposed to serve new perimeter radiators, and existing duct risers previously utilized for the dual-duct HVAC system were repurposed as the main risers for the new core cooling-only air distribution system. Formulating the new system concept around the existing building infrastructure allowed the project team to efficiently use what existing equipment could be salvaged and lower project construction costs.

Operation & Maintenance

Replacing the outdated mechanical and electrical systems which were beyond their useful service lives has dramatically reduced the amount of maintenance required within the facility. The new building automation system coupled with utility metering gives facility operators a tool to more efficiently operate the building and track the impact daily operation decisions have on overall energy consumption.

Cost Effectiveness

KJWW Engineering, along with Substance Architecture, assisted in an assessment of the building's existing infrastructure, which was beyond its usable life. Energy modeling, retro commissioning, and cost analysis were utilized as tools to generate and compare various upgrade strategies. Several innovative concepts were developed in this process, and then tested in various bundles, or strategies, to find an optimum balance between cost, benefit, and performance.

Environmental Impact

The building's 40-percent reduction in overall energy use illustrates how the evolution of equipment technologies over the past 50 years is able to greatly reduce the environmental impact of commercial buildings. This project is a real-world example of how technologies such as electronic building management systems, live metering of building utilities, efficient delivery of ventilation air, and integrated lighting control strategies can be implemented to drastically reduce energy use of existing buildings.

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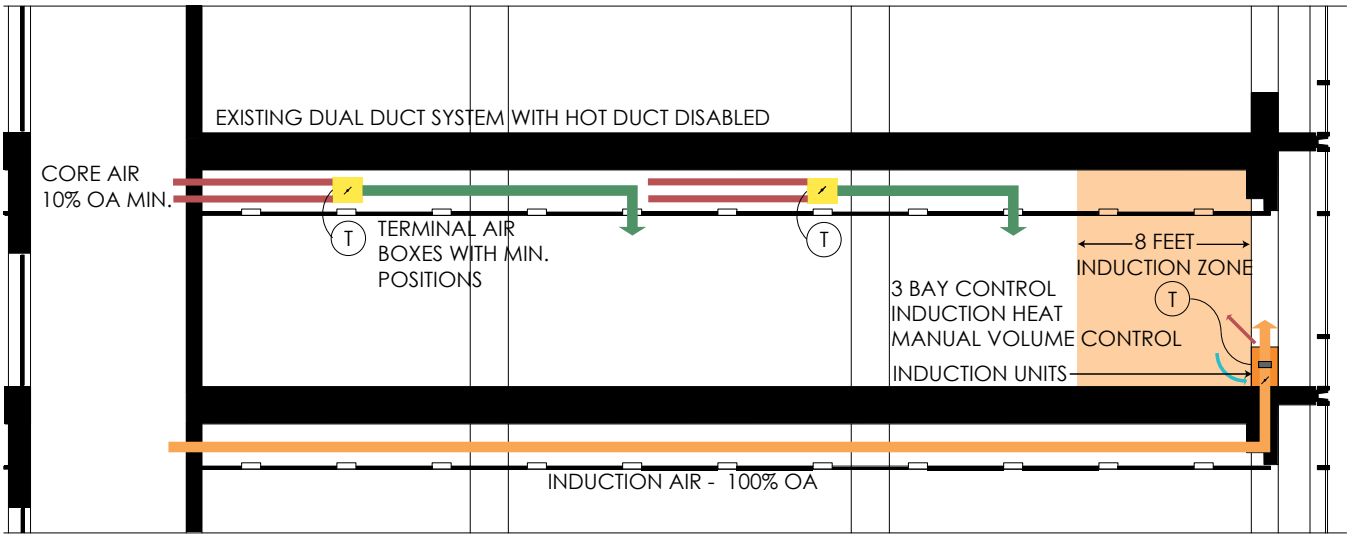
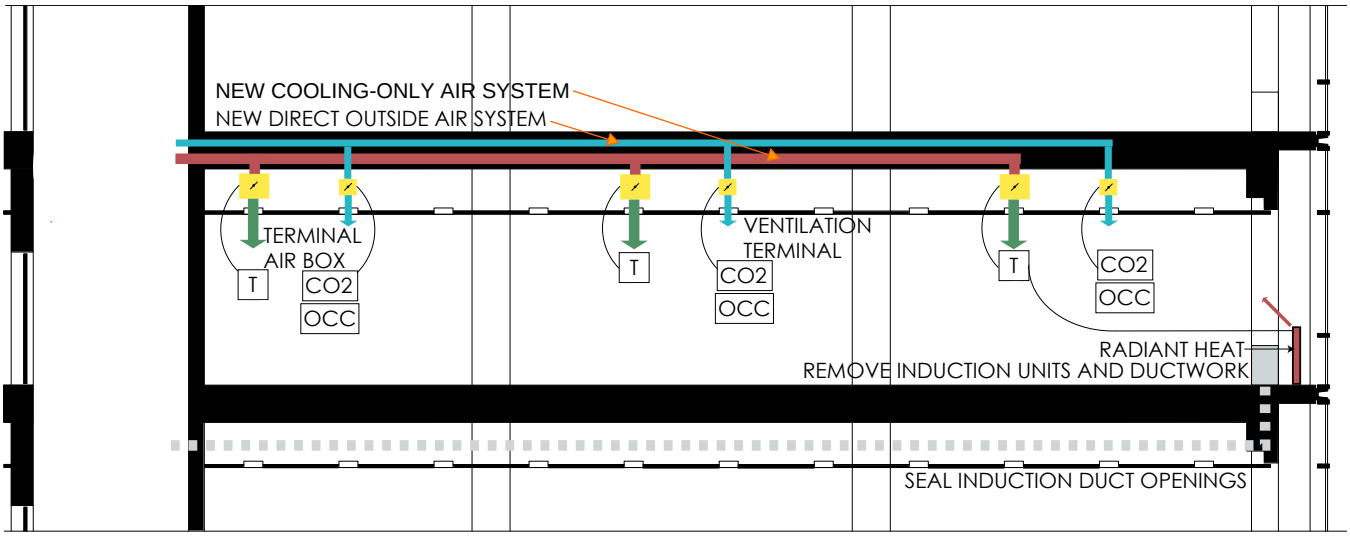


Mechanical System Diagram - Existing Partial Section



Mechanical System Diagram - New Concept Partial Section