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**EVALUATION OF AN EXTENDED-DUCT AIR DELIVERY SYSTEM IN TALL SPACES
CONDITIONED BY ROOFTOP UNITS**

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ABSTRACT

Mixing ventilation in high bay buildings conditioned by rooftop units involves supplying and returning air near the ceiling. Several problems occur in tall spaces, such as higher return air temperatures in the summer and excessive stratification in the winter. A novel air delivery strategy is investigated that involves supplying and returning air at different heights depending on the season. In the summer, air is supplied low and returned just above the occupied zone in order to cool the occupied zone directly, letting the upper zone stratify. In the winter, air is supplied high and returned low in order to draw warm air down from the ceiling, thus promoting destratification. This system's performance was investigated in a full-scale experiment using measured temperature profiles and utility bills. A calibrated EnergyPlus model used measured temperature profiles as an input to a room-air model to study the effects of stratification on building energy consumption. The EnergyPlus model predicts 19% yearly HVAC electricity savings when considering the additional pressure drop of extended ducting and 37% yearly HVAC electricity savings without considering extra pressure drop. A utility bill analysis of the test facility shows a yearly 28.8% reduction in HVAC electricity consumption.