

BUILDING PERFORMANCE

NEWS

Retrofitting Makes Older Buildings Airtight

Airtightness levels can improve significantly after older buildings are retrofitted.

Results of a recent study by IRC in collaboration with Public Works Canada show that old office buildings can be successfully retrofitted to improve airtightness and reduce energy consumption.

Air leakage is suspected to be the major cause of deterioration in aging buildings, consequently, airtightening is now commonly included in building repairs. While the amount of change depends on the extent of the retrofit, airtightness appears to improve and energy use to decrease following retrofitting.

Six Canadian office buildings, ranging from 10 to 26 storeys, were tested for airtightness between 1970 and 1974. Researchers from IRC and Public Works Canada then retested these buildings in 1991. Between testing periods, five of the buildings were retrofitted to improve airtightness. Of these five, researchers found that four are currently more airtight than when they were first tested. Airtightness levels in the fifth building remain unchanged. By comparison, the building with no retrofitting is 23% leakier than it was 20 years ago.

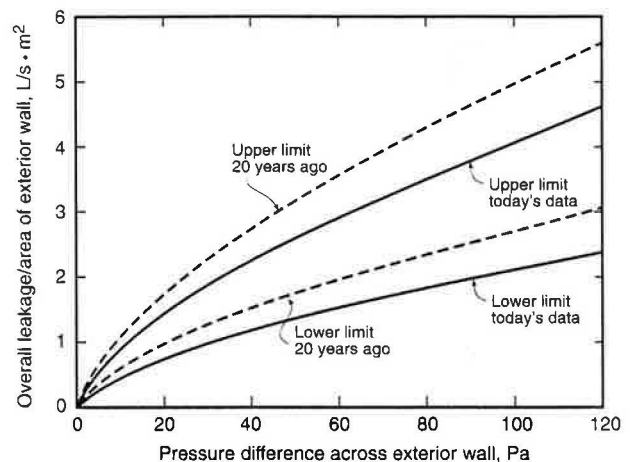
Identical test methods were used in the original and the 1991 tests. The buildings' supply air systems were used to bring in outside air and pressurize the buildings. All return and exhaust fans were turned off. Supply airflow rates were varied and researchers measured the corresponding pressure differences created across the building envelopes at ground and roof levels. By plotting airflow rates against average values of pressure differences measured, researchers could define the air leakage characteristics of the test buildings.

Overall airtightness values of these buildings at 50 Pa (0.2 in. water) varied from 1.36 to 3.65 L/s • m² (0.27 to 0.72 cfm/ft²). These values represented improvements in overall airtightness values at 50 Pa of up to 43% over the original value (see figure).

Improvement in airtightness levels appears to depend on the extent of the retrofit and the original airtightness of the building. The test buildings were retrofitted in various ways, including: installing a new vapour barrier between floors, recaulking and resealing windows, sealing vertical columns from the inside, replacing a metal panel with new curtain wall cladding, and recaulking joints in a curtain wall.

Results of the 1991 tests can be used by designers to estimate air infiltration rates in determining heating and cooling loads, or to calculate energy consumption. The data also provide a realistic basis for establishing an airtightness criterion for office buildings in cold climates, particularly for those buildings that are to be retrofitted.

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This graph illustrates the overall airtightness measured in six office buildings 20 years ago and recently. In general, airtightness improved after retrofit but the overlapping curves indicate that this is not always the case.