Thought Experiments for Evaluating Building Air Leakage Test Procedures

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Modeling Vs Experiments

* How to develop accurate pressurization air leakage testing standards?

* Difficult to do controlled experiments involving wind, temperature and building

* Mathematical modeling not generally used

* Statistics relied on too much?

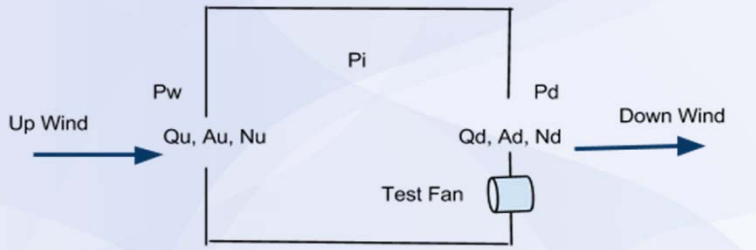
Simplest Useful Model of Building

* static pressure from wind on building
* 2 holes in shell, downwind and upwind
* all flow by power law from pressure
* all holes have same size and exponent

Simplest Useful Model of Wind

* architectural wind load calculator
* pressure downwind is -0.63 times upwind
* wind pressure increase as velocity squared
* wind perpendicular to holes and static

Figure 1 - Simplified Model of a Building Leakage Test With Wind



Pi = Inside pressure (all pressures referenced to barometric)
Po = outside average pressure far from building
Pd = outside pressure near downwind side of building
Pw = outside wind pressure on upwind side of building
Po = outside pressure on downwind side of building
Qu,Au,Nu = flow, area, exponent of upwind hole in building
Qd,Ad,Nd = flow, area, exponent of downwind hole in building

Problems Analyzed With Model

* Where should the outside pressure port be placed?

* When is pres/depres only testing accurate?

* When is pres+depres testing accurate?

Conclusions

***** Simple math models can be made but they need experimental validation

* Need models for stack pressure and more complex cases.

* Windy depres or pres tests require isolated outside pressure tap

* Windy pres+depres testing works better with isolated outside tap