FLORIDA SOLAR ENERGY CENTER®

Creating Energy Independence

Evaluating the Economic Impacts of the Legislatively Delayed Provisions of the 5th Edition (2014) Florida Building Code

FSEC-CR-2024-16

Final Report

Submitted to

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Executive Summary

This research provides an assessment of the potential economic impacts of implementing three legislatively delayed requirements of the Florida Building Code, 5th Edition (2014): 1) residential air leakage testing, 2) residential whole-house mechanical ventilation, and 3) two fire service access elevators for applicable buildings (see Appendix A for code language). This research is based on assessing the costs of implementing the measures without respect to timing. That is, costs of industry not being prepared are not included as the commission and legislature have already addressed those concerns. Rather, this addresses steady-state, direct costs and benefits for each measure once implemented on a regular basis.

In order to provide information on such important topics the research team includes industry experts for each measure as well as an economist to estimate the induced and indirect costs of including such measures in the code. The general process for conducting the research is depicted in Figure E-1.

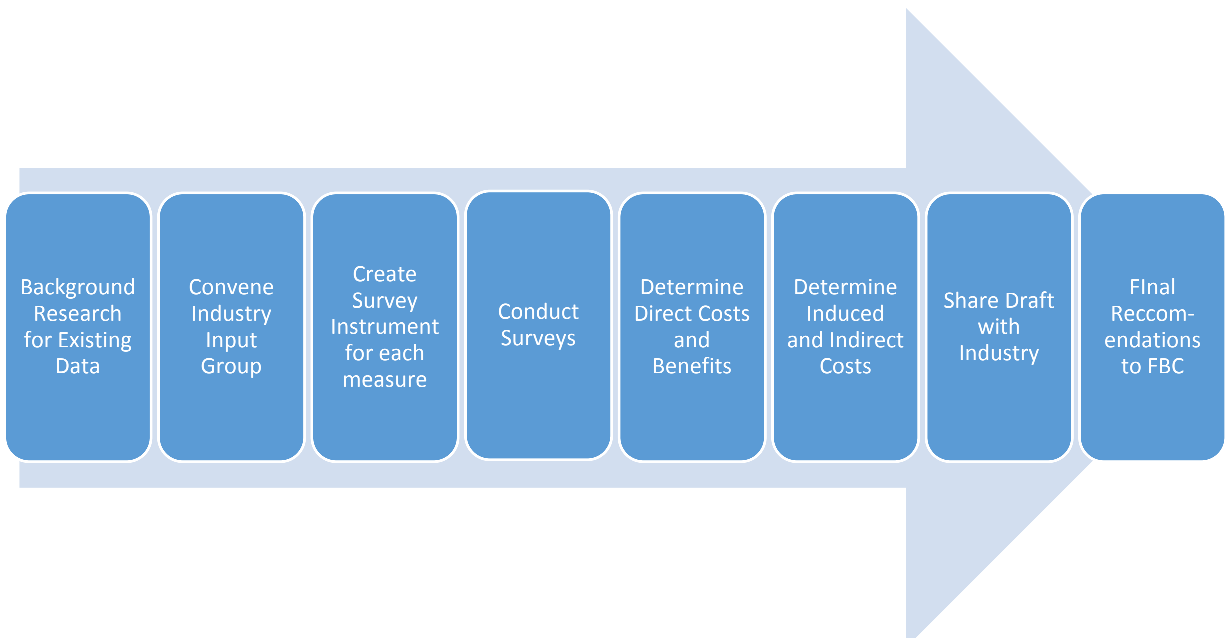


*Figure E-1. **Error! Use the Home tab to apply 0 to the text that you want to appear here.**The research assessed the economic impact of residential air leakage testing, residential mechanical ventilation systems and 2nd fire access elevators, each task following the general process shown.*

Second fire service access elevator

Background of the requirement for fire service access elevators (FSAEs) is provided, including how and when they became part of the code. This report highlights changes in the last three code cycles for fire service access elevators. One 2015 International Building Code (IBC) change is to force the size of the elevator to accommodate an 84” x 24” stretcher. Communication with elevator manufacturers confirmed that this requirement would force the typical 3500 lb. two-door model elevator to be shifted to either a single-door model or go up to the next level (typically more expensive 4500 pound model) of elevator. The Florida supplement to the IBC code altered the language to 76" x 24" which should alleviate this expense. No fire event reports were found as FSAEs are still relatively new.

The research conducted resulted in no recommendations for code changes for the 2nd fire service elevator as survey results and responses were mixed and the industry survey cost estimates were seen as very small relative to the cost of construction. The median cost for a typical second fire service access elevator for a twelve-story building was estimated at $82,000. This is based on an example question where there were two or more elevators already in the building served by the same lobby space. Respondents also indicated that on average, 22.7% of the time their buildings might require a second lobby and that increase in cost would be another $100,000. These costs are small compared to overall project costs. For the last project completed with at least one fire service access elevator, respondents estimated the total cost for designing and constructing the FSAEs and lobbies was 0.32% of the total project cost. The median cost for the FSAEs (1 to 12 FSAEs included in their last project) was $100,000.

Asked if the second fire service access elevator would be beneficial overall (Figure E-2), 76 respondents (45%) indicated *yes* and 93 indicated *no* (55%). Considering the respondents were largely construction related professionals, the 45% answering beneficial overall was higher than anticipated. A number of respondents indicated that perhaps instead of the 12 stories requirement it should be based on square footage or apply to just taller buildings. There were concerns of extra lobby cost for some tall residential projects with a smaller footprint which may have one resident elevator and one service personnel elevator. Such projects may require an additional lobby meeting the fire service access requirements. Concurrently, the Florida legislature took up and passed a bill that provided more flexible lobby requirements for many high rise structures. Details of the responses to each of the survey questions are included in the report.

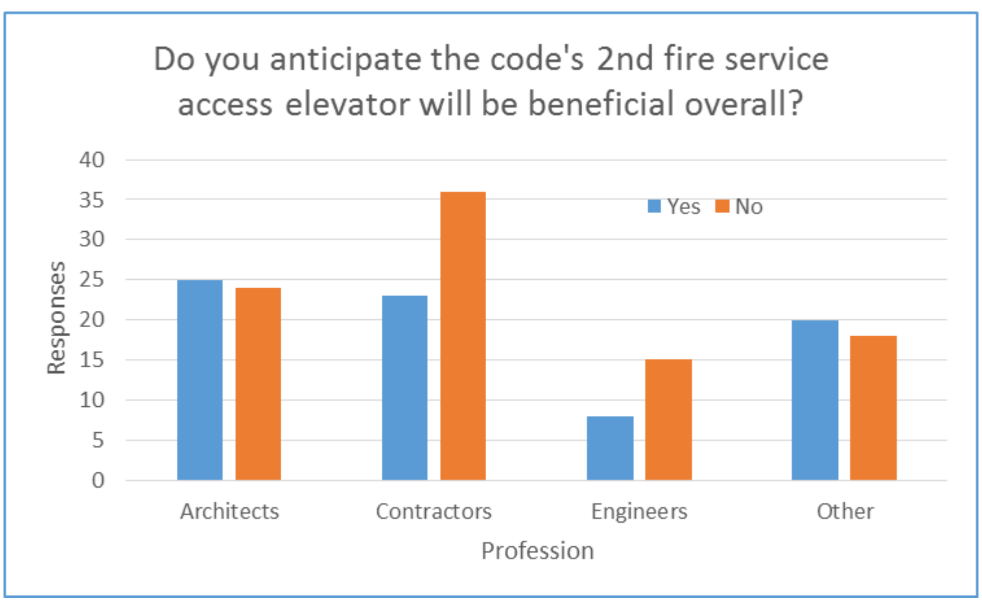


Figure E-2. Respondents' opinion on the overall benefit of the second fire service access elevator.

Air Sealing and Blower Door Testing

Air sealing helps reduce energy bills and control sources of pests, pollutants and moisture. References are provided as to the potential health concerns of uncontrolled infiltration.

A summary of costs of the air sealing measures obtained from the survey are shown in Table E-1. This table shows survey respondents estimated costs for meeting current code language regardless of testing in a 2000 square foot concrete block home (row marked Example House). The next row indicates the cost of those who thought it would take more air sealing to meet a code level of 5 ACH50 (house air leakage of 5 air changes per hour at a pressure of 50 Pascals) in that house. The third row indicates the median and range of those responding; those reporting that it would not cost anything additional to air seal the home were included. Medians are presented for both those with significant experience (having performed > 20 blower door tests) and all those with any experience (having performed > 0 blower door tests).

Table E-1. Air Sealing Cost Survey Results

	> 20 BD Tests		> 0 BD Tests			
	Median	n	Median	10%	90%	n
Example House	$500	56	$600	$100	$2,500	135
Additional air sealing needed to meet 5 ACH50 (only answers saying there would be cost)	$500	23	$500	$125	$2,500	50
Additional air sealing needed to meet 5 ACH50 (includes $0 for those saying none would be needed)	$0	64	$0	$0	$1,000	136

The blower door testing costs are shown in Table E-2. For these costs, respondents were also asked costs of their most recent job and typical costs over the last two years. The costs among the experienced group (> 20 blower door tests) are fairly consistent at $250 to $300.

Table E-2. Blower Door Testing Cost Survey Results

	> 20 BD Tests		> 0 BD Tests			
	Median	n	Median	10%	90%	n
Example House	$300	61	$350	$150	$1,000	134
Last Two Years ENERGYSTAR Homes	$250	37	$250	$60	$700	63
Last Two Years Code	$250	20	$250	$0	$750	42
Last Two Years Other	$250	21	$300	$100	$1,100	40
Most Recent	$250	42	$300	$125	$1,200	81

Residential Whole-House Mechanical Ventilation

Whole-house mechanical ventilation offers the ability to control where and when outside air enters the home. Outside air drawn from proper locations can improve the indoor air quality and result in health benefits for residents. Bringing in outside air whether through uncontrolled infiltration or planned mechanical ventilation can introduce humid air. Different system types are designed to either ignore or address the moisture.

Survey respondents were asked about the cost and type of systems they install and the cost of other HVAC changes they might make due to having a whole-house mechanical ventilation system. Figure E-3 shows that there is no consensus on the system type to install even when presented with the same example house. Table E-3 shows the median costs for the example house question and the most recent job. As shown the more experienced group (with > 10 ventilation system installations) reported a lower cost than the overall group (with > 0 installations). The range of costs is significantly large, varying from $150 to $3500 for the same example house.

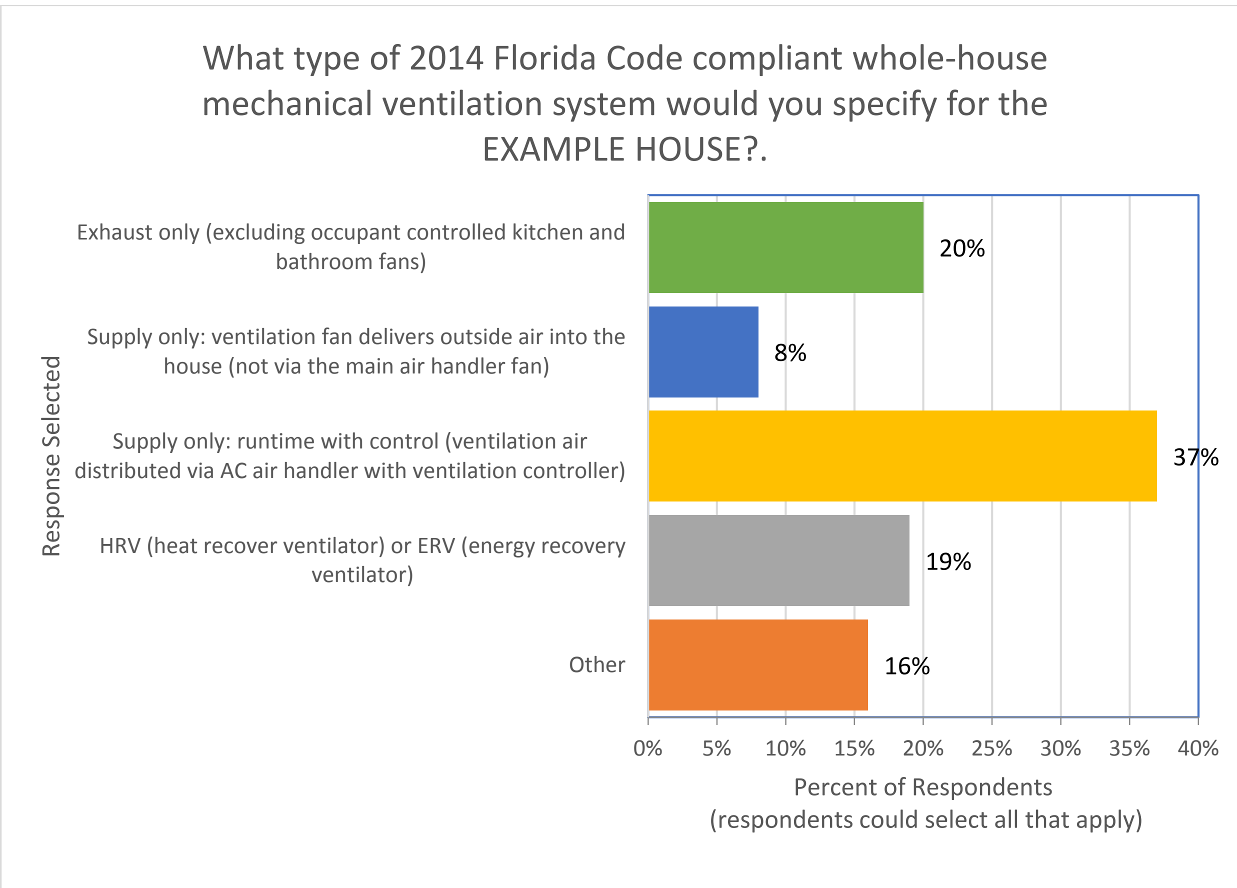
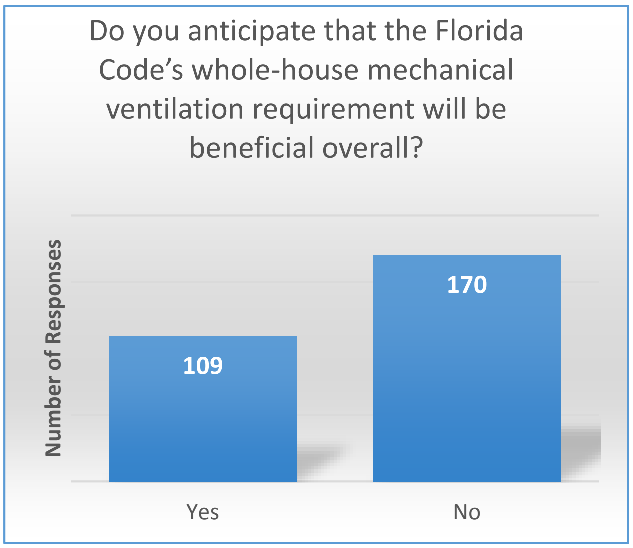


Figure E-3. Whole-house mechanical ventilation system that respondents would specify for the example home provided in the survey.

Table E-3. Whole House Mechanical Ventilation Cost Survey Results

	> 10 Installations		> 0 Installations			
	Median	n	Median	10%	90%	n
Example House	$500	68	$800	$150	$3,500	141
Most Recent	$365	36	$1,200	$150	$8,000	63

Over 60% of the respondents were not anticipating the ventilation requirement to be beneficial overall as shown in Figure E-4. This response about the ventilation requirement was less favorable than the blower door testing which was seen as not beneficial overall by 55% of respondents. Many questions provided opportunity for comments and every comment is included in the report appendix. Comments were often very constructive while some used the opportunity to “vent” their frustrations.



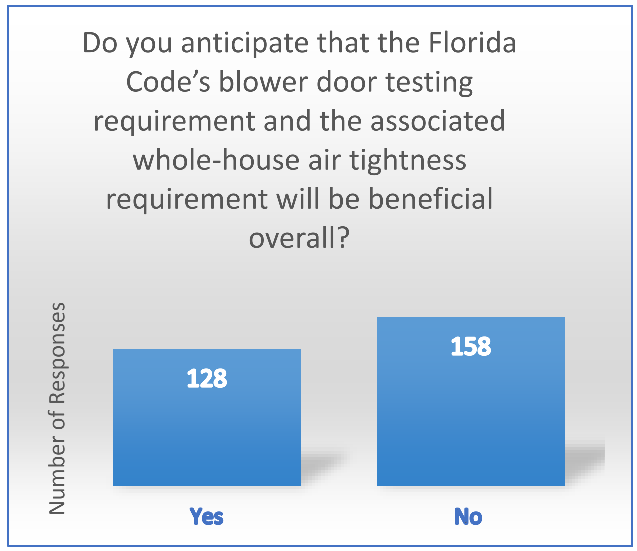


Figure E-4. More respondents were unfavorable towards the anticipated code changes than were favorable.

The authors present four residential recommendations based on this and prior research:

- Whole-house air tightness testing is recommended
- Whole-house air leakage of up to 7 ACH50 is recommended
- Whole-house mechanical ventilation systems capable of ventilating homes to ASHRAE Standard 62.2-2013 are recommended with the caveat that more guidance and experience is needed for Florida’s homebuilding industry to gain confidence that homes can be maintained at acceptable humidity and comfort
- More research on whole-house mechanical ventilation systems is recommended.

Direct, Indirect and Induced Economic Impact

The costs of construction increase to meet these new code requirements. These costs have two direct effects, one in increasing employment in the construction industry to accomplish the code change, and another in increasing in sales price which could lead to reduced sales of homes or high-rises. An evaluation of these two effects was made on air sealing homes, blower door testing, and whole house mechanical ventilation systems for residences and on the second fire access elevator requirement on high rise structures. The economic evaluations were based on responses to the example cost questions on the surveys. On the whole, the economic model results are positive for the economy based on the increased construction activity. It is estimated that the net 202 sustained jobs resulting from the code changes would result in another 252 indirect jobs and 159 induced jobs, for a total of 613 jobs sustained, leading to $43.5M in GDP and $83.9M in statewide spending with an estimated $2.7M returned to state and local governments in the form of taxes. No beneficial dollar amount was assigned to the health and welfare aspect, or energy impact that may results from these code changes.

Industry Presentations

The survey results have been presented to local industry groups and in the case of the elevator work, through two state-wide webinars. Comments received are included in the report and tend to be consistent with those received in the survey but at times have provided additional information. For example, one homebuilder indicated that if his homes have to be tested to achieve 5 ACH50, then he will build to 3 ACH50 to make sure he will pass the test.

Work Scope and Introduction

The Florida Building Commission retained the Florida Solar Energy Center, a research institute of the University of Central Florida, to assess the potential economic impacts of implementing three legislatively delayed requirements of the Florida Building Code, 5th Edition (2014) (see Appendix A for code language). Each code requirement is a separate research task:

> Task 1: Section R402.4.1.2, Energy Conservation volume - the air leakage testing requirement for residential buildings - herein referred to as “Testing”,
>
> Task 2: Section R303.4, Residential volume - the whole-house mechanical ventilation requirement for residential buildings – herein referred to as “Ventilation”, and
>
> Task 3: Section 403.6.1, Building volume - the requirement for two fire service access elevators - herein referred to as “Elevator”.

In Task 4 researchers presented preliminary findings for each requirement to industry groups to obtain stakeholder feedback.

Project Activities

Work included fulfilling Institutional Review Board (IRB) requirements, background research, organizing and convening two industry advisory committees, developing and administering two online surveys, promoting and distributing the surveys, reviewing and analyzing survey response data, estimating induced and indirect costs, sharing results with industry, considering if results warranted any code change recommendations and writing this report. Figure 1 summarizes the steps taken in this project.

Background research involved a literature search for existing benefit and economic data relevant to the three tasks as well as benefits. Researchers also solicited cost data from major service providers related to the three tasks.

Two industry advisory committees were formed, one for Tasks 1 and 2 (both residential) and one for Task 3. The research team drafted survey questions for each task. Each advisory committee reviewed the questions and provided feedback to improve the clarity of the questions and address omission of important economic considerations. The final surveys received approval from UCF’s IRB. FSEC administered the survey using Qualtrics, an online survey tool. Researchers analyzed responses using tools within Qualtrics as well as Microsoft Excel.

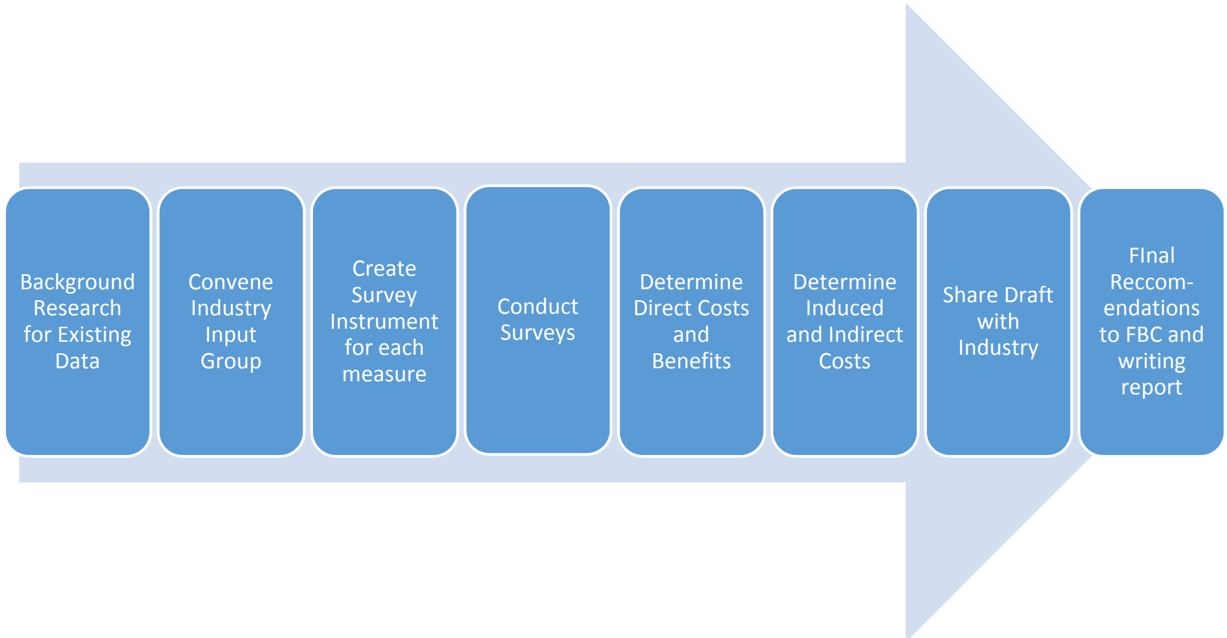


Figure 1. The research assessed the economic impact of residential air leakage testing, residential mechanical ventilation systems and 2nd fire access elevators, each task following the general process shown.

Costs and Other Numeric Data Presented from Survey Results

The following sections (Tasks 1, 2, and 3) will include survey results. For those survey questions where respondents were asked to indicate the cost of an item, the data were carefully examined. If a respondent indicated 0 for something that would clearly have a cost (e.g., adding a 2nd fire service access elevator), the response was eliminated along with anyone not answering. Responses such as 123456789 or a million dollars for a blower door test were eliminated as non-responsive as well.

For each of the questions presenting costs, the first value presented in this report will be the median of those with experience. That value was the basis for the indirect and induced costs covered later. For the FSAE survey, those with experience were those who had indicated having five or more jobs involving FSAEs. For the residential blower door and air sealing questions, those deemed to be experienced indicated more than 20 blower door testing jobs. For the whole-house mechanical ventilation system questions, there was a smaller number of respondents with experience and cost data, so the experienced group was considered those with more than 10 jobs.

The authors believe that the median is the best representation of a typical expected cost available from the survey data. Medians avoid skewing problems associated with using means, which for cost estimates will tend to skew high with just a few very large dollar responses.

Knowing the range of values is of interest also. However, the lowest and highest value in a range can be misleading particularly when people are providing estimates. Some may not be fully knowledgeable, have left out or added a zero when typing, or have reason to bias the results. The authors have selected to present what they feel is a better representative range by showing the value representing the 10% lowest cost (10% of all responses were at that value or lower) and the 90% highest cost (90% of all responses were at that value or lower). For most questions assessing costs there was significant range. Using the 10% and 90% values provides a range of the middle 80% of responses. So for cost questions, the more experienced group median as well as the median of the total respondents with some experience will be presented, along with the 10% and 90% values of those responses.

In some cases the survey asked for other (non-cost) numerical answers such as the last job ACH50 (house tightness level –air changes per hour tested at 50 Pascals). In those cases, similar analysis is presented for the medians and range.

Each survey asked a number of open-ended questions. All comments received from those questions are included in the Appendices.

Task 1: Air Leakage Testing and Task 2: Ventilation

Based on industry advisory committee feedback, it was decided to combine the Task 1 (air leakage / blower door testing requirement) and Task 2 (mechanical ventilation requirement) research activities and survey documents. The target audiences had significant overlap, and as the committee advised, it would be confusing and difficult to get responses to two surveys from essentially the same groups at the same time.

Air Sealing and Blower Door Testing Background Research

Costs of Blower Door Testing

A 2015 Petition for Emergency Rulemaking by the Florida Building Commission[1] included an estimated cost range for blower door testing from the Florida Home Builders Association Green Building Council of $200 to $300 per house. The Florida Solar Energy Center (FSEC) provided a professional opinion letter to the Florida Building Commission,[2] in which, based on professional experience, it estimated that blower door testing for a typical single family homes would involve 35 – 55 minutes on-site to conduct a seven-step test process, not including time for contractor communications and delivering the required test report.

Additional, existing blower door testing data has been collected from two certified home energy rating organizations. One provider has conducted over 11,000 blower door tests since 2009. They indicated a blower door test cost of $150 each for large groups of homes located in close proximity and agreed with the typical prices of $200-$300. The other energy rater provided cost data reflecting an average of $350 for blower door testing in about 70 homes.

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[1] "Amended Petition for Emergency Rulemaking by the Florida Building Commission." June 9, 2015. Accessed July 29, 2015: http://www.floridabuilding.org/fbc/commission/FBC_0615/Commission/Amended_Petition_for_Emergency_Rulemaking_by_the_FBC.pdf

[2] Vieira, R. Letter to Florida Building Commission Chairman Richard Browdy. June 9, 2015.

Air Leakage Rates

Extensive whole-house air tightness and leakage data of Florida code level homes is not readily available. One recent study (Withers and Vieira 2014) measured the air leakage of 31 new Florida homes and the homes averaged 5.6 ACH50. This was not much different than a 2003 study (Cummings, et al. 2003) of 11 existing homes. Table 1 indicates the results of some FSEC studies where home air leakage was measured. The last column has the web address for the report containing the data.

Table 1. FSEC Residential Air Leakage Studies

	N	Average ACH50	Range ACH50	Year Built	Reference
Code Ventilation Study 2015, Sonne et al.	21	3.8	1.2 - 8.8	1987-2014	http://www.fsec.ucf.edu/en/publications/pdf/FSEC-CR-2002-15.pdf
Gainesville Ventilation Study 2014, Martin et al.	10	3.21	1 - 5.1	2009-10	http://fsec.ucf.edu/en/publications/pdf/FSEC-PF-461-14.pdf
Code Effectiveness Study 2014, Withers et al.	31	5.6	3 - 11	2009	http://fsec.ucf.edu/en/publications/pdf/FSEC-CR-1934-12.pdf
Multi-family Field Study 2014, Chasar	1,421	6.1	2.3 - 13.6	2010-13	http://fsec.ucf.edu/en/publications/pdf/FSEC-PF-457-14.pdf
Air Handler Leakage Study 2003, Cummings et al.	11	5.71	3.72 - 9.98	2001	http://www.fsec.ucf.edu/en/publications/html/FSEC-RR-138-03/index.htm

Above-code homes such as those certified to meet the ENERGY STAR for Homes standard, are often those that obtain energy ratings which involves air tightness testing. An analysis of rated homes in the EnergyGauge database for Florida homes registered over a two year period are shown in Figure 2. A 2006 International Energy Conservation Code (IECC) home would score at around a 100 Home Energy Rating System (HERS) Index. A score of zero would be a home that produces as much energy as it uses. The vast majority of homes in the data set that are under a HERS Index of 50 have an ACH50 of less than 5. However, many homes shown with ACH50 of over 10 still achieved HERS Index scores of 50 to 80. Clearly, even in above-code homes there is a large range of air leakage currently.

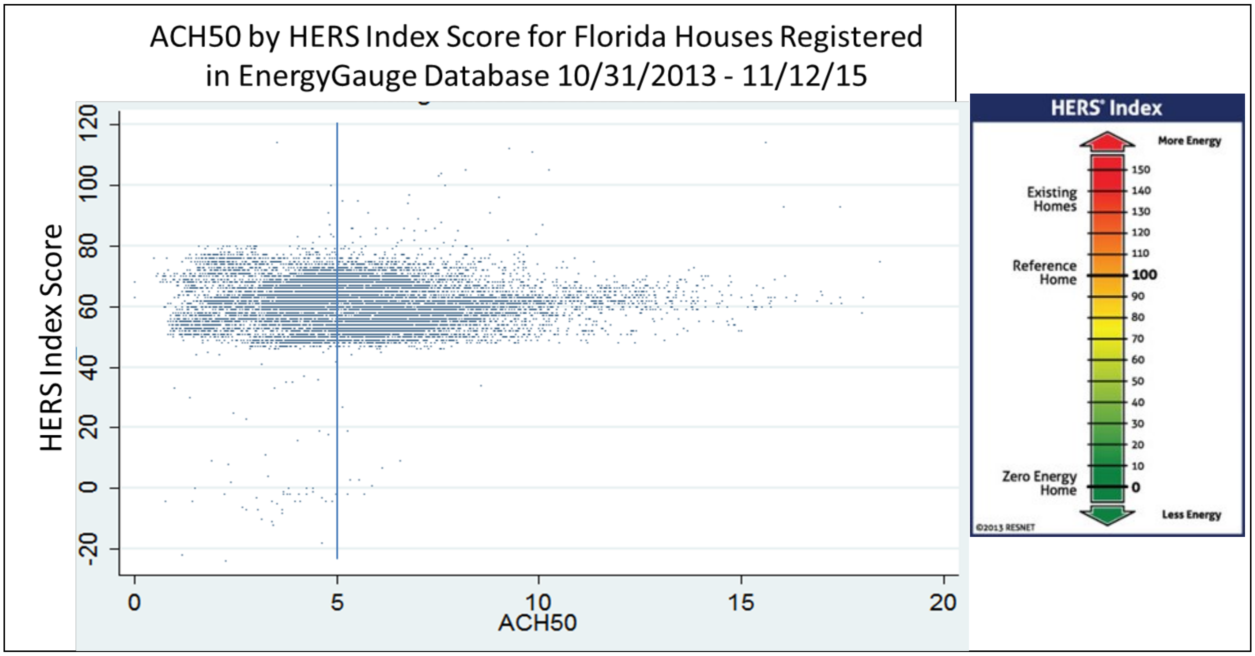

Figure 2. Typically above-code homes receive energy ratings. Among those homes there is a large range of air leakage.

Benefits of Air Sealing

The airtightness of a home's floor, walls, and ceiling allow for the containment of the conditioned air produced by the heating and cooling systems. A reasonably tight envelope prevents the warmth, coolness, and dryness produced by the HVAC system from literally drifting away through natural air exchange through unintended pathways (Cummings et al. 2012). If indoor air cannot be contained, it cannot be controlled.

Envelope airtightness enables indoor temperature control. When envelope air tightness is consistent throughout a house, it improves the evenness of temperature throughout the house. If one space has a high envelope leakage, it may create a "hot spot" of discomfort.

Slight increases in tightness in Florida homes save only a little energy due to our mild temperature difference. When mechanical ventilation air is provided to tighter homes, the ventilation fans may consume more energy more than the lower infiltration saves. The EnergyGauge USA simulation analysis conducted for the code ventilation study referenced above for an example Tampa climate home (Sonne et al. 2015) is shown in Table 2. Going from 5 ACH50 to 7 ACH50 is estimated to save 149 kilowatt hours (kWh) per year. If an energy recovery ventilator (ERV) is used to ventilate and consumes 1 watt (W) per cubic feet of air delivered per minute (cfm), savings are reduced to 132 kWh if the ventilation rate remains constant. If credit for infiltration is given, consistent with ASHRAE Standard 62.2 2013, then due to reduced mechanical fan power the leakier home is estimated to save energy.

Table 2. EnergyGauge Modeled Total Annual Energy Use Comparison for an Example Two-story, 2400 sq. ft., 3 Bedroom, 2014 FL Code House in Tampa (1 Watt/cfm ERV)(from Sonne et al. 2015)

ACH50	No ventilation		2014 FL Code Ventilation Requirement		ASHRAE 62.2-2013 Ventilation Requirement	
	cfm	kWh	cfm	kWh	cfm	kWh
3	0	12,146	60	12,855	72.8	13,003
5	0	12,315	60	13,008	53.3	12,933
7	0	12,464	60	13,140	34.0	12,851

Other benefits of tighter homes are less objectively evaluated. Benefits include possible fewer pollutants from garage spaces (depending on location of leaks) or other locations of unhealthy air such as dusty attics and damp crawlspaces. Sealing holes and cracks in floor, wall, and ceiling/attic assemblies reduces pathways for pests. Exposure to cockroach dander has been linked to negative health outcomes for occupants with asthma and allergies (Kanchongkittiphon et al. 2015). Additionally, envelope airtightness limits infiltration of unconditioned air and its attendant heat, humidity, and particulates (dust, smog, pollen, car exhaust, air borne pollutants, etc.) into the occupied space (Chandra et al. 1997, 2002).

Testing to assure homes meet some minimum level of tightness will likely result in reduced callbacks for builders and could avoid occasional serious problems in homes where a combination of events lead to condensation on building materials. And reducing infiltration will reduce moisture loads.

Envelope airtightness enables indoor humidity control, which is particularly important in Florida. When outdoor air exchange is low, mainly moisture generated by processes such as cooking and bathing is added to the conditioned space. The conditioned air is recirculated through the cooling system over and over where moisture is condensed out of the air and drained to the outside keeping indoor humidity levels low. High indoor moisture levels and associated proliferation of mold, mildew, and dust mite growth have been linked to childhood asthma (Bonner et al. 2006). High indoor humidity has been linked to multiple adverse health effects. The Committee on Damp Indoor Spaces and Health convened by the Institute of Medicine of the National Academy of Sciences on behalf of the U.S. Centers for Disease Control did a comprehensive review of scientific literature addressing the relationship between damp or moldy indoor environments and the appearance of adverse health effects in exposed populations. The committee found the epidemiologic evidence to show an association between exposure to damp indoor environments and adverse health effects, including upper respiratory (nasal and throat) symptoms, cough, wheeze, and asthma symptoms in sensitized persons with asthma. The committee found limited or suggestive evidence of an association between exposure to damp indoor environments and dyspnea (shortness of breath), lower respiratory illness in otherwise healthy children, and asthma development. (IOM 2004).

Proponents of the “build tight, ventilation right” strategy, argue that providing fresh air using a control air flow path delivers higher quality outdoor air than the outdoor air that is introduced through uncontrolled infiltration.

Whole-House Mechanical Ventilation Background Research

Costs of Residential Whole House Mechanical Ventilation Systems

A limited amount of whole-house mechanical ventilation cost data was found and the references indicate a range of costs:

- The National Renewable Energy Laboratory (NREL) Residential Efficiency Measures Database[3] indicates an average cost for an energy recovery ventilator (ERV) of $1,300 to implement
- Referring to runtime ventilation systems with control, a 2013 DOE Building Technologies Program document[4] states that “Building America has refined simple whole-house ventilation systems that cost less than $350 to install.”
- A Minnesota Sustainable Housing Initiative article[5] estimates medium-sized (70-120cfm) recovery ventilators to cost between $600 and $1100, with ERVs costing $150 to $200 more than comparable HRVs and installation adding $1200 to $1500. High-efficiency models add $250 to the cost of comparably sized average-efficiency units.
- Lawrence Berkeley Lab cost examples for California range from less than $300 - $600 for single point exhaust systems to $900 – above $2,000 for ERVs[6]

Benefits of Whole House Mechanical Ventilation Systems

Whole-house mechanical ventilation provides a means of diluting and removing indoor air pollutants. Benefits can include improved indoor air quality, better control over the outdoor air source and air flow rate, and improved comfort through filtering and conditioning the outdoor air (EPA n.d.).

Considerations of how much whole-house ventilation air to provide and when to provide it include indoor pollutant levels, natural ventilation (infiltration and intentional passive ventilation), outdoor air quality, temperature and humidity levels, and costs. A comprehensive discussion of these factors is beyond the scope of this project, but several considerations are presented.

Indoor Air Pollution Sources

A discussion of health impacts from common residential indoor air pollutants is available in a Lawrence Berkeley National Laboratory (LBNL) report: *A Method to Estimate the Chronic Health Impact of Air Pollutants in U.S. Residences* (Logue et al. 2012). The report concludes that chronic exposure to three pollutants: $PM_{2.5}$ (particulate matter up to 2.5 microns in size),

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[3] http://www.nrel.gov/ap/retrofits/measures.cfm?gId=10&ctId=236
[4]http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/1_3a_ba_innov_lowcostventilation_011713.pdf
[5] http://www.mnshi.umn.edu/kb/scale/hrverv.html
[6] https://resaveguide.lbl.gov/whole-building-ventilation-examples

acrolein, and formaldehyde “dominate health impacts due chronic exposures to non-biological air pollutants.”

The LBNL publication discusses these pollution sources in terms of “disability-adjusted life-years (DALYs) lost:

> *The DALY losses from these three pollutants appear to be much larger than the DALY losses due to CO deaths from acute poisoning in homes. [Secondhand smoke] and radon are also significant contributors to population wide DALY losses, but these exposures occur in a smaller fraction of homes.*

Formaldehyde content in building products was specifically noted during the April Florida Building Commission Energy Technical Advisory Committee code modification meeting. A U.S. Environmental Protection Agency (EPA) online publication (EPA 2016) provides an overview of the status of formaldehyde emission standards. The publication states that “there are currently no national standards in place for formaldehyde in composite wood products,” but goes on to describe regulations the EPA is finalizing to implement a 2010 federal Formaldehyde Standards for Composite Wood Products Act which limits emissions from composite wood products based on standards which had previously been adopted in California.

Health-Based Ventilation Benefits Research

A survey of available health-based ventilation research found a number of publications that in some way address the topic, but also found that direct links between mechanical ventilation and health are still being studied. An online EPA indoor air quality booklet (EPA 2016) summarizes the status of health-based ventilation research as follows:

> *While pollutants commonly found in indoor air are responsible for many harmful effects, there is considerable uncertainty about what concentrations or periods of exposure are necessary to produce specific health problems. People also react very differently to exposure to indoor air pollutants. Further research is needed to better understand which health effects occur after exposure to the average pollutant concentrations found in homes and which occur from the higher concentrations that occur for short periods of time.*

A 2016 Lawrence Berkeley National Laboratory web article (LBNL 2016a) provides a similar summary, but notes indirect evidence for a ventilation rate health effect:

> *Very little research has been conducted on the relationship of ventilation rates in homes with the health of the occupants of the homes. The results of a few studies suggest that children in homes with low ventilation rates have more allergic or respiratory symptoms compared to children in homes with high ventilation rates. There is also indirect evidence that ventilation rates of homes will affect health by modifying the indoor concentrations of a broad range of indoor-generated air pollutants.*

A related Lawrence Berkeley National Laboratory article (LBNL 2016b) provides additional considerations regarding indirect health effects:

> *From numerous experimental studies, as well as from theoretical modeling, we know that higher ventilation rates will reduce indoor concentrations of a broad range of indoor-generated air pollutants. Because exposures to some of these air pollutants, for example, environmental tobacco smoke and formaldehyde, have been linked with adverse health…, we expect that increased home ventilation rates will reduce the associated health effects.*

A position paper "The Case for Mechanical Ventilation and Air Tightness Requirements in Florida" (included in Appendix B) was provided by the Home Ventilating Institute (HVI) during this delayed code provision period in support of keeping the Florida Code's 5 ACH50 building air leakage limit and whole-house mechanical ventilation requirement. Regarding reducing the mechanical ventilation trigger from 5 ACH50 to 3 ACH50, the paper states:

> *If Florida's legislature elects to roll back the mechanical ventilation requirement to only apply to homes tighter than 3 ACH50, studies indicate that the net effect will increase occupant formaldehyde exposure by 40% or more, with higher spikes expected in hot humid summer conditions when formaldehyde emissions are highest.*

Indoor Humidity Levels and Ventilation

Another concern in our humid Florida climate is indoor humidity levels. Depending on how much outside air is brought into homes and if or how that air is conditioned, the latent cooling load can be significantly affected. Health effects associated with indoor humidity levels include respiratory infections and allergies (also described above), and humidity levels have also been found to affect the rate of formaldehyde off-gassing (Arundel et al. 1986).

Humidity concerns were noted by the Florida Building Commission's Energy Technical Advisory Committee at its April code modification meeting as it considered building air leakage and ventilation related modification proposals and public comment on these proposals that included the HVI outdoor air benefits argument noted above.

Additional discussion of ventilation latent loads is available in a 2014 the Florida Department of Business and Professional Regulations (DBPR) funded FSEC report: *A Review of Home Airtightness and Ventilation Approaches for Florida Building Commission Research* (Sonne and Vieira 2014). Table 3 provides a whole-house mechanical ventilation summary table from this report that includes "pros" and "cons" for each ventilation strategy.

Table 3. Whole-house Mechanical Ventilation Options
(adapted from Sonne and Vieira 2014)

Ventilation Option	Description	Pros	Cons
Supply Only	Outdoor air is supplied into home via a small fan and single duct or multiple ducts to zones.	Potentially low first and operation cost (depending on fan power use). Positive pressure drives conditioned air through envelope cracks and holes limiting infiltration through building cavities. Outdoor air can be filtered and conditioned (e.g. if dropped near air handler return).	Heat and/or energy (enthalpy) recovery not possible. Poor outdoor air distribution if single duct; also seasonally elevated RH where air is delivered.
Exhaust Only	House air is exhausted from home via a small fan and a single duct.	Low first and operation cost. Off-the-shelf system with limited design requirements	Negative pressure in home brings unconditioned outdoor air into home through building envelope; can lead to significant moisture related problems. Can also bring in air from undesirable locations such as the attic and garage. Heat and/or energy (enthalpy) recovery not possible.
Balanced with or without Recovery	Supply fan and duct brings outdoor air into home while exhaust fan and duct remove indoor air.	Balanced or positive house pressure possible. Outside air can be conditioned via heat or energy (enthalpy) recovery.	Energy recovery not effective at times in swing seasons. Uses two fans so twice as much energy use for ventilation. Higher first cost than exhaust or supply systems.
Runtime	Duct supplies outdoor air to return side of air handler. Airflow is driven by the air handler fan during conditioning and, in some systems, during periods of non-conditioning using a fan cycling controller.	Control strategies can limit excessive outdoor air and provide outdoor air at times where there is no call for cooling or heating.	Energy use of large air handler fan used to provide relatively small amount of air (can be minimized with variable speed air handler fan and high efficiency motors).

To mitigate the increased latent load associated with mechanical ventilation, some industry experts recommend dehumidification (Sherman, 2006). A separate DBPR funded 2014 FSEC report (Withers and Sonne 2014) includes a discussion of indoor humidity levels and dehumidification strategies. Table 4 below from that study provides a listing of supplemental dehumidification system types together with estimates of first costs and “pros” and “cons” for each option.

Table 4. Supplemental Humidity Mitigation Options (adapted From Withers and Sonne 2014)

Supplemental Dehumidification System	First-Cost Estimate Including Labor	Pros	Cons
Overcooling (increased air conditioning to remove moisture)	**$0**	Low first cost. User control.	Results in cold, clammy discomfort. No help during non-conditioning periods (swing seasons). Energy inefficient
Lowering air handler fan speed to increase contact time of air with cooling coil	$0-$75	Improved dehumidification. Owner may be able to do this.	Some loss in cooling efficiency. No help in swing season.
Heat pipes	$3000	Can reduce heating and cooling loads from ventilation. Long life, low maintenance	May not have room to install. No help in swing season.
Enthalpy recovery ventilation	$700-$1400	Can reduce heating and cooling loads from ventilation. Balanced house pressure possible.	Extra energy to run the two fans needed. No help in swing season.
Dual capacity air conditioner	$1800*	Low speed can result in lower energy use while saving energy	Higher first cost. Better than single cap., but still some hours swing season it will not operate.
Variable capacity air conditioner ventilation	$3700*	Excellent efficiency. Longer run times. Good RH control. Good ventilation mixing.	High first cost. New on residential market, so more to learn.
Dedicated outdoor air system	$7000	Good RH control. Excellent ventilation effectiveness potential.	High first cost.
Mini-split Dedicated outdoor air system	$3200	Good RH control. High-efficiency.	Hard to size solely for low flows. Some localized overcooling may occur at times. Good mixing depends upon central fan cycling.
Stand-alone Dehumidifier with Remote Humidistat	$500-$2000**	Works with or without AC. Good RH control.	Energy -inefficient. Adds heat, some RH dead bands can be excessive. Noise may be issue.
Integrated Ducted Dehumidifier	$1,000-2000**	Works with or without AC. Good RH control. Air is distributed better than stand-alone. Noise issue less likely than stand-alone	Energy -inefficient. Adds heat, some RH dead bands have been found excessive
Sub-cooling Reheat	$1,600	Good RH Control. More efficient than dehumidifiers.	Overcools and then heats, using energy for both. High first cost.
Full-condensing Reheat	$1,750	Good RH Control. More efficient than dehumidifiers.	Overcools and then heats, using energy for both. High first cost.
Desiccant Dehumidifier	$2,000	Good RH control. Has potential to be recharged by solar or gas	Higher first cost,

* cost increase compared to single capacity SEER 13 system.

** Wide variability in cost depending upon capacity, availability of space, and if condensate pump is needed.

Assembling a Testing and Ventilation Industry Advisory Committee

The purpose of the residential industry advisory committee was to provide expert input and advice during the development of the survey tool, assist with recommending contacts for distribution of the survey, and to provide other relevant blower door testing and mechanical ventilation cost data.

The residential industry advisory committee included representatives from the following organizations and stakeholder groups:

- Florida Refrigeration & Air Conditioning Contractors Association (FRACCA)
- Florida Home Builders Association (FHBA)
- Florida Weatherization Network
- Florida home energy raters (3 companies)
- EPA ENERGY STAR for New Homes program
- Production builders (1 national builder, 2 independent)
- Custom builder (1)

The authors thank the members of this committee who are listed in Table 5.

An effort to include mechanical ventilation equipment manufacturers in the advisory group was initially successful but that member dropped out. We could not attract a mechanical ventilation supplier within the window of opportunity to participate. Based on advice from legal counsel no one currently serving on the FBC or TACs was requested to serve.

Testing and Ventilation Survey Instrument

Draft blower door testing and mechanical ventilation surveys were developed and reviewed by the residential industry advisory group during a combined live on-site meeting with some attendees using a webinar portal held Oct. 16, 2015 (meeting agenda provided in Appendix C).

Based on industry advisory committee feedback, it was decided to combine the Task 1 (air leakage / blower door testing requirement) and Task 2 (mechanical ventilation requirement) research activities and survey documents as the group consensus was that it would be confusing and difficult to get responses to two surveys at the same time. Both surveys targeted the same audience.

Based on industry advisory committee input, survey modifications were made and the separate blower door testing and mechanical ventilation surveys were combined into one survey. The survey was designed to be taken on-line to take advantage of advanced analysis and export options of the Qualtrics survey tool. Respondents were asked about past experience, anticipated impact of implementing these two code provisions, and for input on a specific example house. To minimize time required to take this combined longer survey, question logic was included; for example, if a respondent indicated they had not been involved with any blower door tests in the past, they would not see any questions about past blower door testing work (they would however still see questions about anticipated future blower door testing work).

Table 5. The following members volunteered their time as part of the residential industry advisory committee who provided input towards developing and distributing the survey.

Stakeholder Group	Organization(s)	First	Last
Homebuilders Production, independent	Viera Builders, Director of Purchasing	Trevor	Lewis
Homebuilders Production, national	VP of Purchasing in Orlando	Andrew	Moore
Homebuilders Above-code programs	ICF (Energy Star Program Management)	Charley	Haack
Homebuilders Affordable	South Sarasota Habitat for Humanity	Michael	Sollitto
Homebuilders Custom	Fallman, Inc.	Paul	Fallman
Homebuilders, Custom Florida Home Builders Association	Hickman Homes (Director of Governmental Affairs' designee)	Mike	Hickman
Mechanical Contractors, Testing - Home Energy Rater	CalcsPlus	Dennis	Stroer
Mechanical Contractors, Florida Refrigeration & Air Conditioning Contractors Association	AMBROSE AIR, INC. ACCA/Central Florida Board of Directors, Chair Code and Licensing Committee	Pat	Ambrose
Testing - Home Energy Raters	SkyeTec	Keinnie	Magruder
Testing - Home Energy Raters	TopBuild (Masco) Homes Services	Layla	Thomas
Testing - Home Energy Raters	Florida Solar Energy Center	Tei	Kucharski
Testing - Home Energy Raters	SkyeTec	Tommy	Spain
Testing – Weatherization Florida Weatherization Network	St Johns Housing Partnership	Bill	Lazar

A second meeting of the residential industry advisory committee convened again on October 30 (see Appendix C for the announcement to committee) using the same teleconference and webinar interface to review the combined and refined survey. Subsequently, staff used the UCF Qualtrics survey tool to design and organize the survey instrument. The survey was designed and tested by five staff members prior to release. The final survey instrument was approved by the UCF Institutional Review Board and is provided in Appendix D.

Testing and Ventilation Survey distribution

The initial email announcing the online survey went out on November 6, 2015 to a list of 24,000 general contractors, energy raters, and an FSEC buildings research newsletter mailing list. Thousands were returned as undelivered. A much smaller group was returned with a request for sender identification before the email would be delivered; these requests were fulfilled in an effort to maximize survey exposure. The survey was also sent by DBPR to 5,000 people on their code mailing list. The announcement was also sent to certified home energy raters in the EnergyGauge Office database on November 10. Committee members with FRACCA, FHBA, and one of the individual home energy raters indicated intent to distribute the announcement also. FSEC provided distribution partners with boilerplate announcement language to minimize bias. An email was sent from FSEC on November 16 that reminded professionals to take the survey by the November 20 survey response deadline. The email included links to both the testing/ventilation and access elevator surveys and was sent to a list of 47,000 people. Many of those recipients had little to no connection to residential construction or knowledge of costs but a wide net was cast in order to obtain sufficient respondents. The survey was kept open for three extra days and closed November 23, 2015.

Testing and Ventilation Survey Responses

There were a total of 832 respondents, with 561 considered fully completed surveys (summary report provided in Appendix E). Asked "Have you been involved in the construction of new Florida homes over the PAST TWO YEARS?", 79% indicated *yes* and 21% indicated *no*. Every Florida County is represented by the respondents ranging from a low of 10 in Union County to a high of 118 in Palm Beach County.

Identified Professionals and Experience

The respondents were asked to select their profession from a list of choices. Figure 3 shows the results. Dominant professions were home builder, HVAC and other contractors, certified home energy raters; these combined account for 615 respondents. The weatherization industry, other blower door testing providers, mechanical engineers, and code officials participated in lower numbers. Of those indicating *Other,* there were 51 that indicated "architect" and 31 "general contractor", presumably seen to the respondent as different from "home builder".

There were 220 respondents who indicated one or more experiences to the question of "Approximately how many blower door tests have you conducted or had conducted for new Florida homes you built or worked on over the PAST TWO YEARS?" A histogram of responses is shown in Figure 4. For some of the economic analysis in this report, the respondents are broken up into two groups –ones that responded with more than 20 blower door tests (78), and all those with one or more blower door tests (220).

There were 328 respondents who indicated one or more experiences to the question "Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the PAST TWO YEARS in new Florida homes?" A histogram of responses is shown in Figure 5. For some of the economic analysis in this report, the respondents are broken up into two groups –ones that responded with more than 10 whole-house mechanical ventilation system installations (132), and all those with one or more installations (328). A smaller number of experiences was used to define the experienced group for mechanical ventilation economic analysis than for the blower door testing because there were fewer respondents providing costs of those systems and a reasonable number in the sample groups was desired.

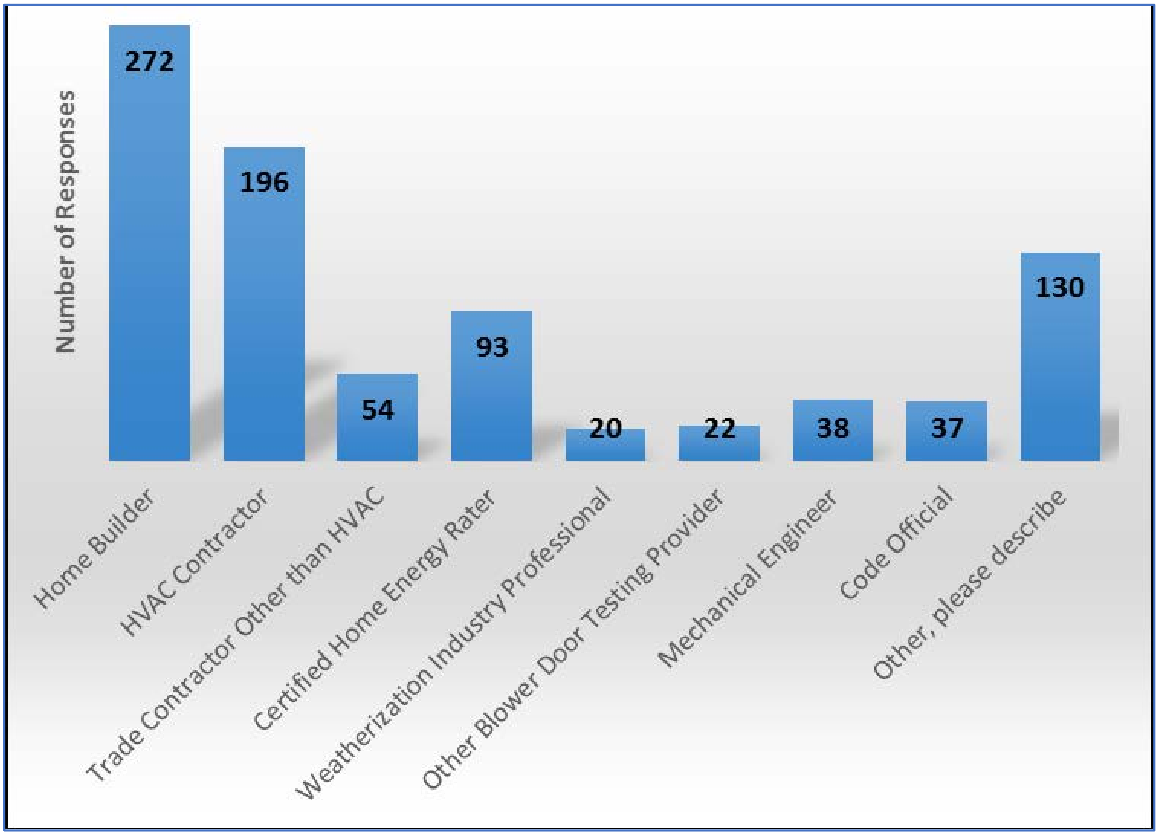


Figure 3. Selected Profession of Respondents

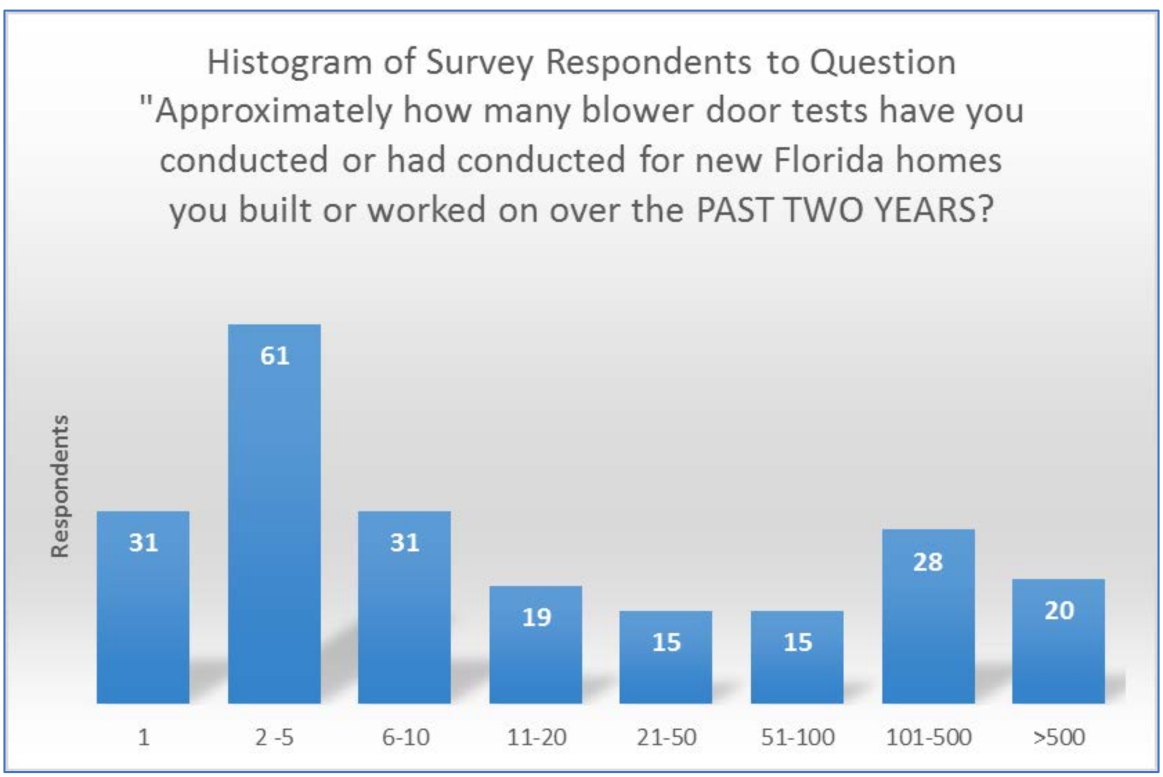


Figure 4. Blower Door Testing Experience of Respondents

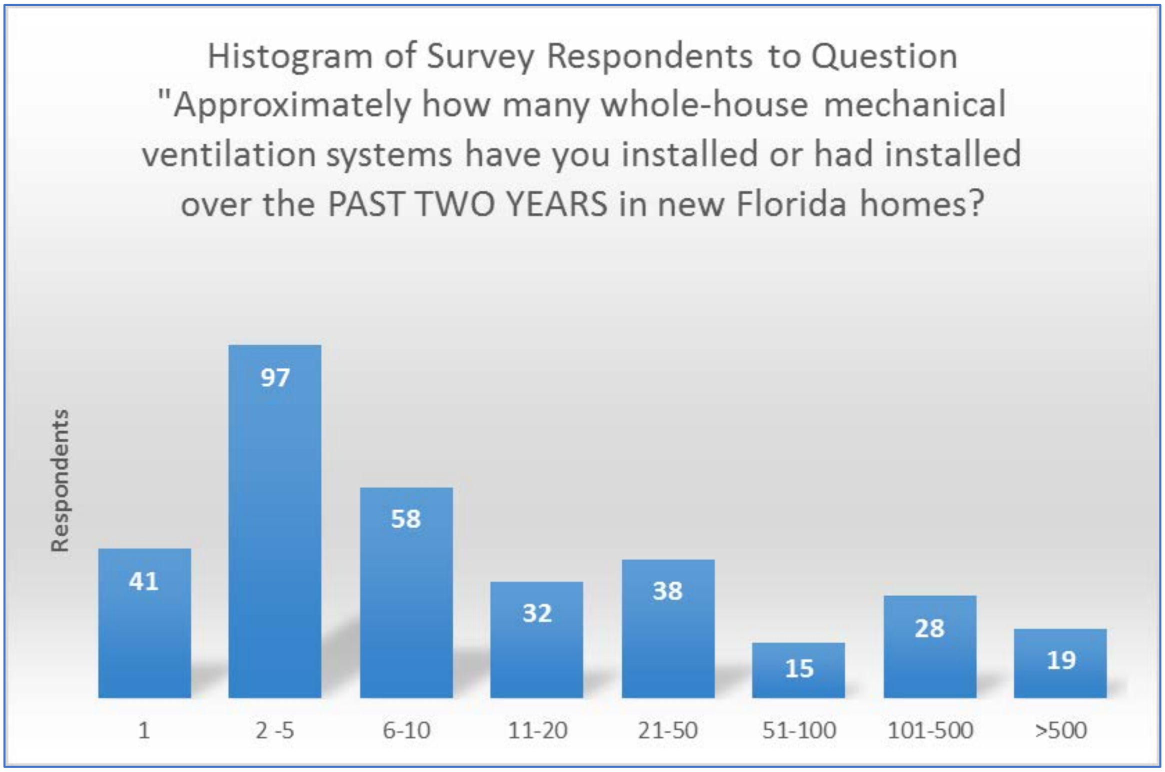


Figure 5. Mechanical Ventilation Installation Experience

Example House

In order to determine costs, an example house summary description was provided. This allows all respondents to provide information on the same house. Later we will report the respondents' estimate of costs for their most recent job (which represents varying house size, configuration, and system complexity). The example house was described as "A new, Florida Code compliant, single-story, single family detached, concrete block house, all electric (heat pump, water heater, and all appliances), with 2,000 ft2 of conditioned area, 9' ceiling height, 3 bedrooms, and 2 baths." The example also stated "For reference: ACH50 refers to the air leakage rate measured using a blower door at 0.2 inches w.g. (50 Pascals)."

Air Sealing Costs for Example House

The survey instrument provided this question "Estimate the cost ($) to the builder for typical air sealing measures for the EXAMPLE HOUSE built to the Florida Code's MINIMUM REQUIREMENTS. (See Table R402.4.1.1 Air Barrier And Insulation Installation of the Florida Building Code, Energy Conservation, Chapter 4)", and provided a full text link. The median response of the experienced group (more than 20 blower door testing jobs) was $500 while the median of all respondents was $600 as shown in Figure 6. Ten percent thought it would cost $100 or less while the highest 10% thought $2500 or more. This cost represents measures done with the current (and past) codes to comply without any testing.

The follow-up question was "Would any additional air sealing be necessary to reach the required blower door test result of no greater than 5 ACH50?" Responses were mixed with about the same number of respondents indicated *yes*, *no* and *I don't know* as illustrated in Figure 7. Then the survey asked only those who replied *yes*, "If yes, please estimate the additional cost ($)?" The median was $500 from both the more experienced and the overall group. The lowest ten percent of respondents thought it would cost $125 or less, while the highest ten percent thought it would cost $2500 or more as shown on the top chart of Figure 8. The bottom chart calculates the same values except it includes respondents indicating there would be no additional cost. Factoring in these "$0" responses drops the median for the question to $0.

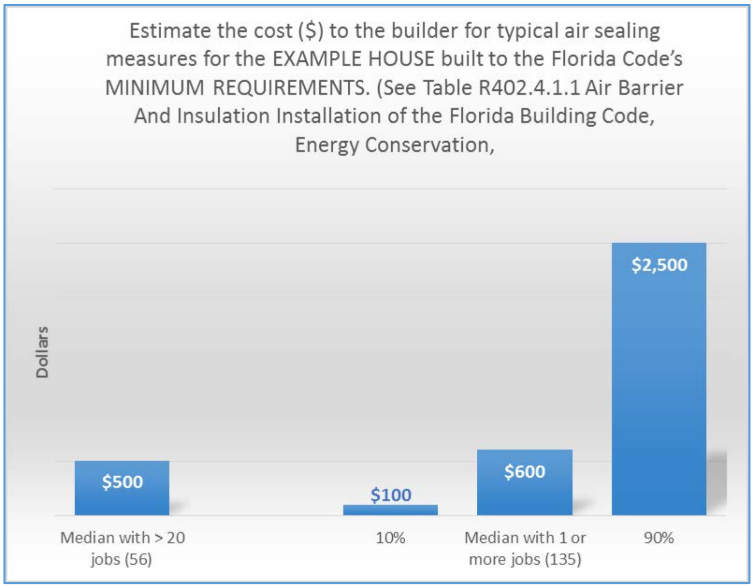


Figure 6. Air Sealing Cost estimates for Complying with Code for Example House

The respondents who indicated *yes* were asked to indicate what additional measures would be necessary to air seal. Those comments are provided in Appendix G and include "sealing electrical components, plumbing and ventilation wall/roof penetrations" and "windows, doors electrical outlets and light fixtures interior."

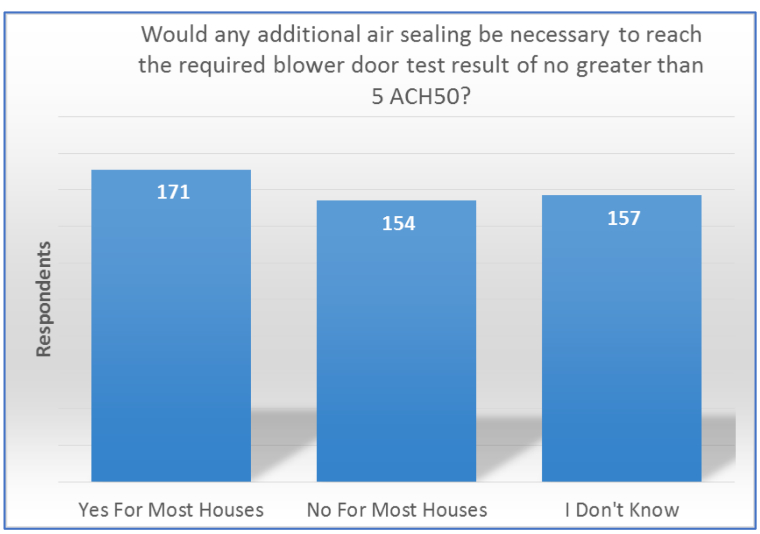
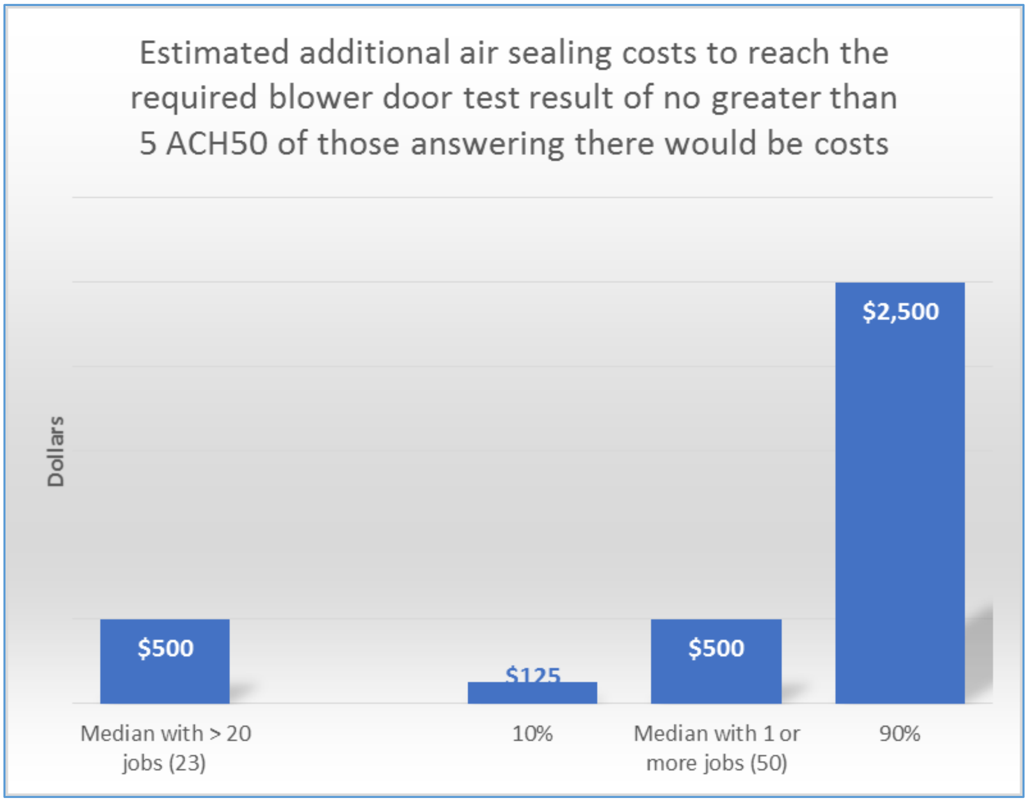


Figure 7. Respondents estimate as to whether additional air sealing than currently is required would be needed to meet a 5 ACH50 standard



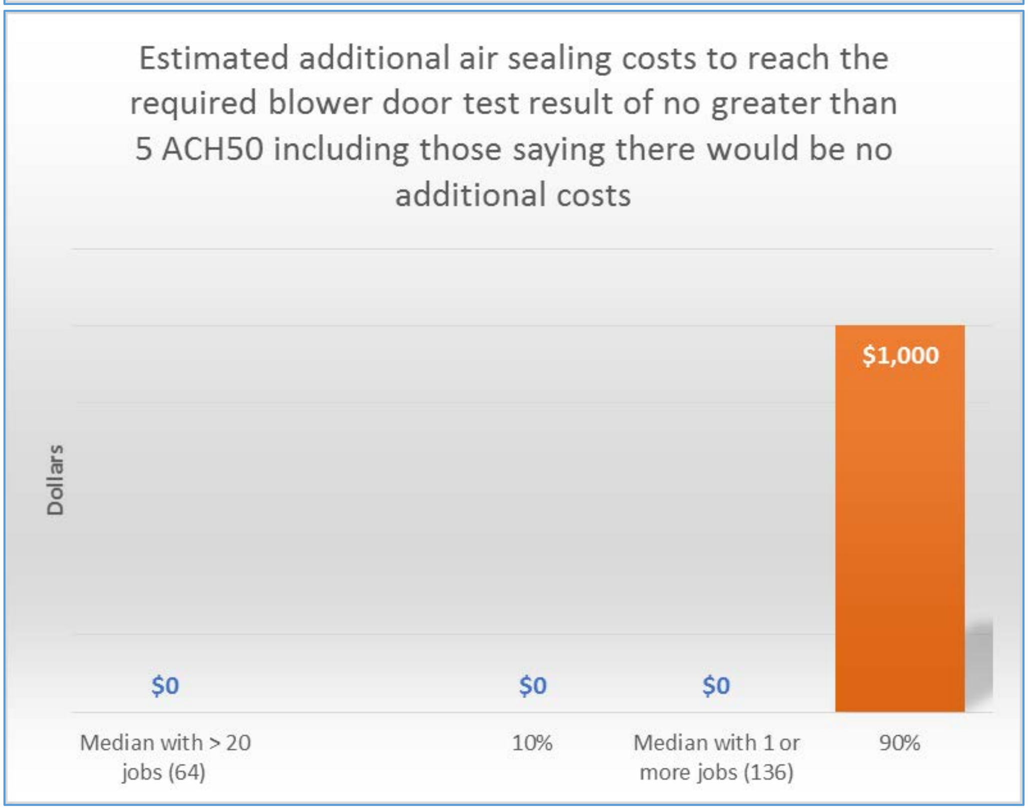


Figure 8. The top figure shows estimated additional costs to comply with 5 ACH50 for example house for those respondents indicating there would be costs while bottom figure shows median and 10% and 90% level of those answering including those indicating no additional costs

Blower Door Testing for Example House

The survey instrument had a number of questions directed at the cost of conducting a blower door test. Using the same example house the first questions was as follows: "Estimate the cost to builder for conducting a blower door test and all associated reporting and communications for the EXAMPLE HOUSE assuming it is within the tester's normal service area." There were locations to fill 1.) *The Estimated cost to builder for testing, associated reporting, and all communications ($),* and 2.) *On-site time needed to conduct test (hours),* and 3.) *How long, if at all, would normal site activity need to stop for testing (hours),*" and 4.) *Fee for retesting, if necessary ($).*A summary of those results is presented in Table 6. The median of the experienced group is very similar to the overall median for all four items.

Table 6. Estimated Cost and Time Associated with Blower Door Testing of Example Home

Example House Blower Door Cost and Time	The Estimated cost to builder for testing, associated reporting, and all communications ($)	On-site time needed to conduct test (hours)	How long, if at all, would normal site activity need to stop for testing (hours)	Fee for retesting, if necessary ($)
Median of respondents with > 20 jobs	$300 n=61	2.0 n=61	1.0 n=61	$150 n=60
10% estimate of all respondents	$150 n=134	1.0 n=134	0.0 n=133	$75 n=130
Median of all respondents	$350 n=134	2.0 n=134	1.0 n=133	$200 n=130
90% estimate of all respondents	$1,000 n=134	6.0 n=134	8.0 n=133	$575 n=130

Respondents were asked if there were reasons why the blower door testing cost may increase or decrease. All comments received from 181 people are in Appendix G. One respondent indicated, "Resistant people who fail to coordinate this work in a timely fashion and work schedule." as a reason to increase cost while, "Helpful people who facilitate to coordinate this work in a timely fashion and work schedule." would decrease cost. One person wrote, "Trying to find leakage in concealed spaces could take up to 8 hours and require smoke testing at an additional cost. Accessing areas for repairs could force removal and replacement of finish materials adding days of delay and costs of up to $1,000." A number of responses were along the lines that the cost would increase if the house was not properly sealed. One respondent commented, "Remaining on the job while house is repaired to get it to pass." Another wrote "If builder and trades were not trained in proper air sealing techniques then repeated failures would result in higher fees."

When asked to "Estimate when the builder could expect to receive the testing results" the majority indicated from 1 to 3 days while others indicated they did not know and 19.5% thought it would take longer than 5 days as shown in Figure 9. Cross tabulation of results (included in

Appendix F) indicate that those conducting tests were more likely to respond *The same or next business day* than home builders (55% of energy raters and 62% of other blower door testing professional compared to 38% of home builders).

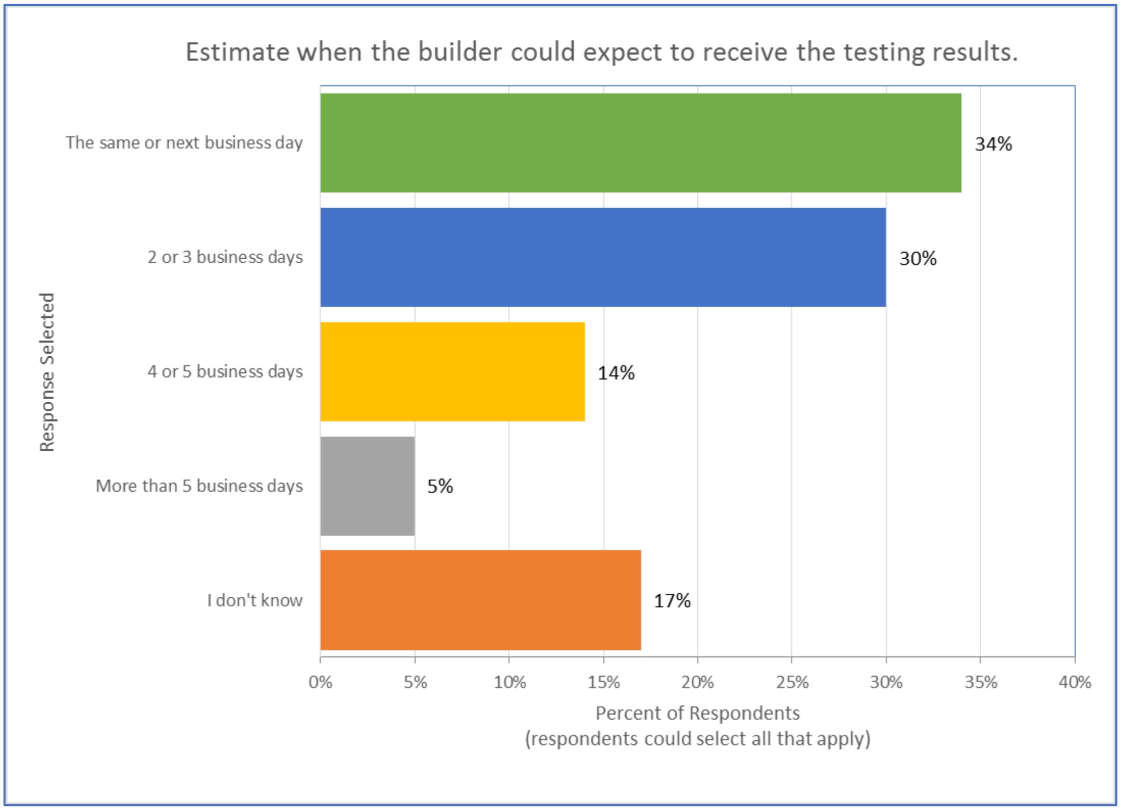


Figure 9. Estimate of when builders could expect blower door results.

Whole House Mechanical Ventilation System for Example House

The survey tool was used to solicit cost estimates for installing a whole-house mechanical ventilation system for the same example house described above. First the type of system was requested. "What type of 2014 Florida Code compliant whole-house mechanical ventilation system would you specify for the EXAMPLE HOUSE (select one answer)?" Results are presented in Figure 10. Thirty-seven percent indicated a supply only system through the air handler with control. Another 20% indicated exhaust only and 19% said an HRV (heat recovery ventilator) or ERV (energy recovery ventilator), 16% indicated they would select a system other than the choices we describe and 8% indicated a supply only system not through the air handler. This large variation in system types indicates that the home building and mechanical ventilation industry has not converged on one type of system for a given house. Of those indicating other system types, 11 people indicated a dehumidifier based system.

The cost of the ventilation system for the example house was determined from the question "Estimated cost ($) of this system to the builder including equipment and installation." The median of the experienced group (more than 10 installations) was $500 and the median of all respondents with one or more installations was $800. The lowest ten percent of respondents thought it would cost $150 or less while the highest ten percent thought it would cost $3500 or more as shown in Figure 11.

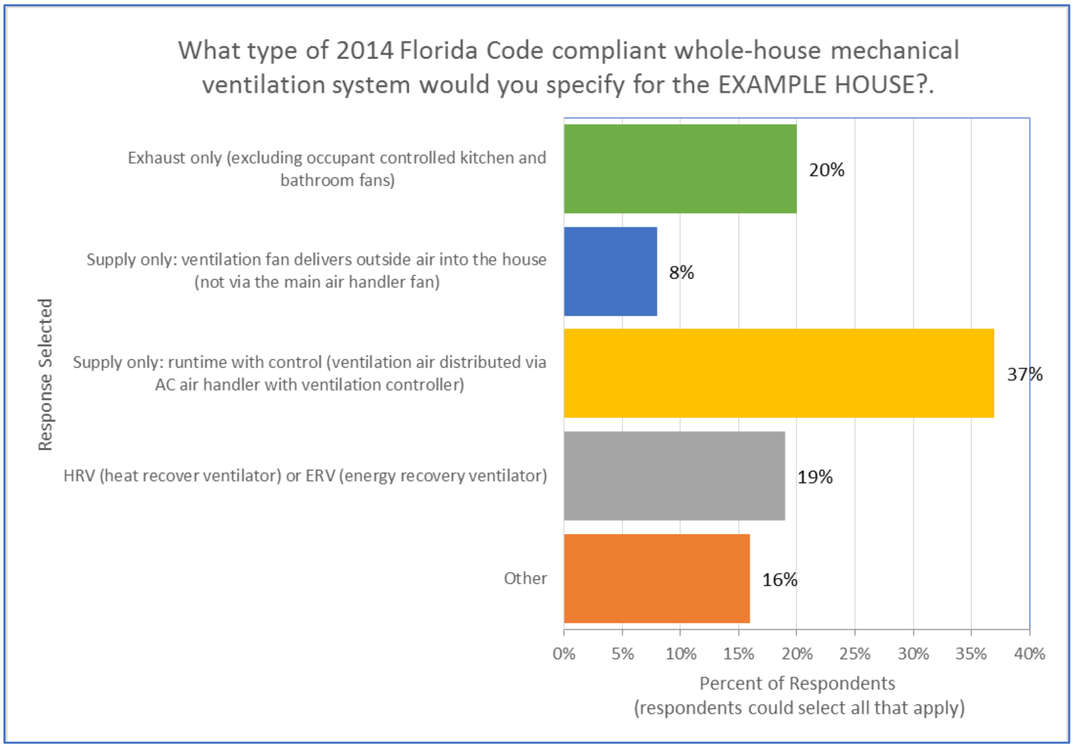


Figure 10. Type of ventilation system respondent would specify for example home.

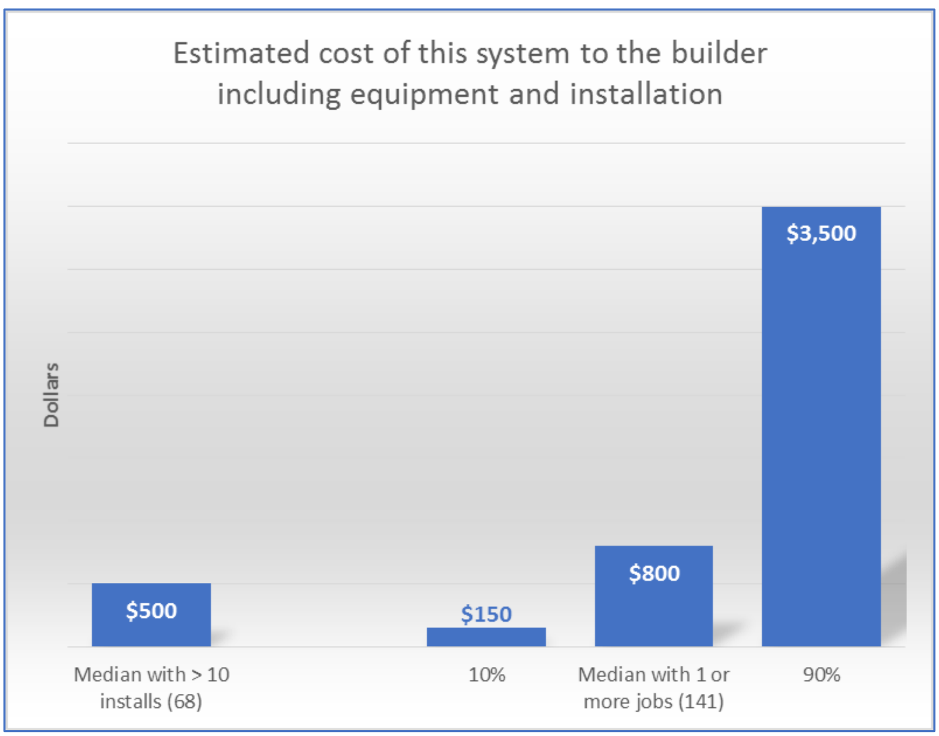


Figure 11 Estimated cost of installed whole-house mechanical ventilation system for example home

Comments received with cost estimates included a variety of reasons for the costs given. One respondent gave a full break down of estimated cost: “$1200 for ERV, $600 Installation Materials, $400 Labor, and $600 Overhead & Profit.”

Respondents were asked “Estimated time on-site in hours,” needed to install a whole-house mechanical ventilation system in the example house. The median time was 2.0 hours among the experience group and 4.0 hours among the larger sample having installed at least one system in the past two years as shown in Figure 12.

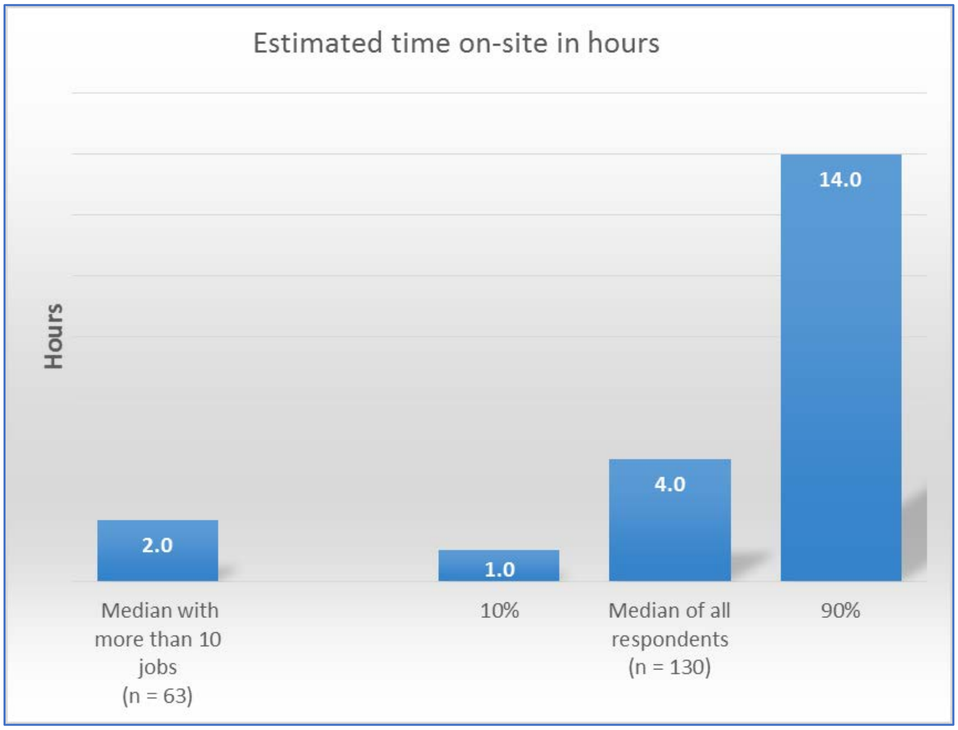


Figure 12. Estimated time on-site in hours to install whole house mechanical ventilation system in the example house.

When asked about factors that would increase or decrease the costs, respondents had a variety of responses. One indicated, “If additional ventilation is required, lawsuits related to mold and humidity problems when these systems fail could be in the $millions.” Another indicated the specifics of the house might determine increases, “It was assumed going thru gable wall, going thru roof add $600. Two-stories with 1st floor could range from $300 to $2000 more depending on floor joist design and any required soffit for ERV. The new A/C has to be resized and increase to cover the extra incoming air average adds $1,500 more.”

Additional heating and cooling system costs due to mechanical ventilation for example home

The mechanical ventilation system will introduce more outside air into the home. This may increase heating or cooling loads or increase the humidity level in the home. A question was asked, “Would you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE?” Sixty percent (60%) indicated *yes*, while 28% indicated *no* and 12% selected *I don’t know*.

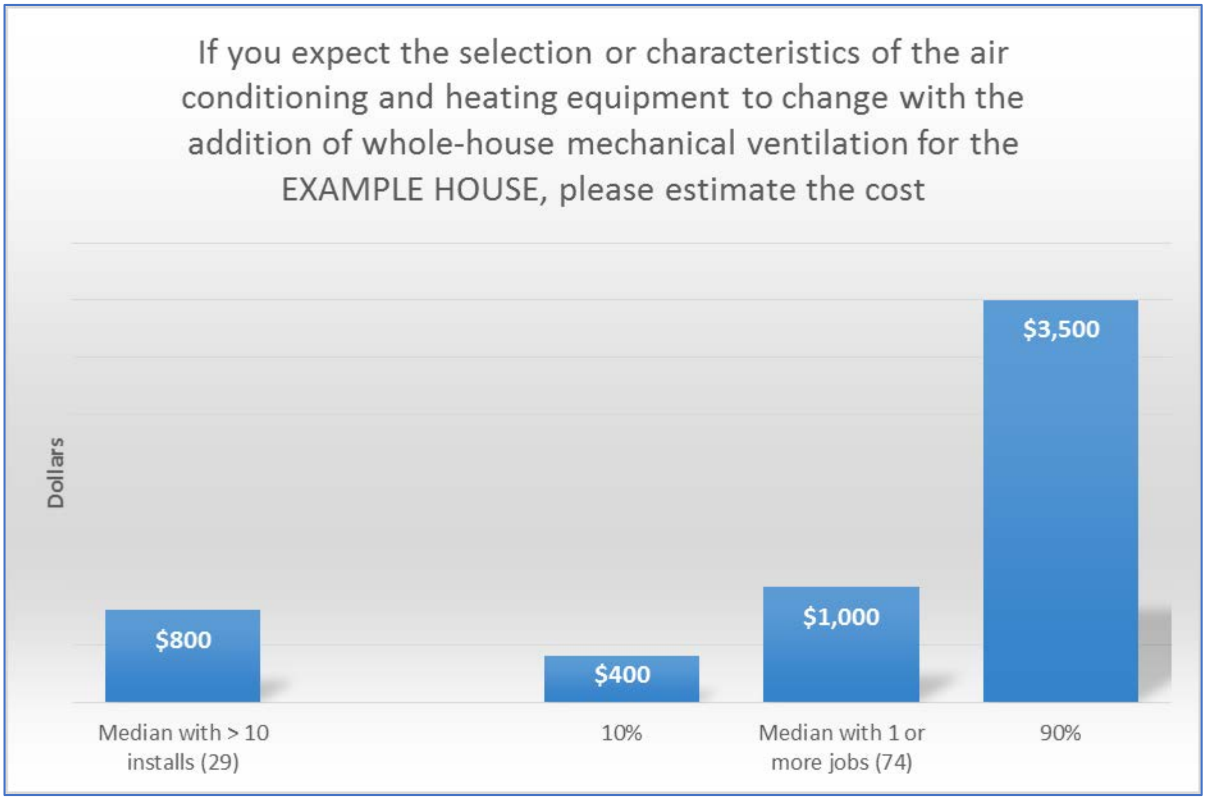
The following question was used to determine cost from the 60% indicating *yes*. “If you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE, please estimate the cost and describe the changes needed?” The results are presented two ways. Once using just those 60% answering *yes* that there would be cost (Figure 13 top chart), and again if the 28% indicating *no* cost ($0) are included (Figure 13 bottom chart). Comparing the two charts in Figure 13, note that the median for the experienced group dips from $800 to $0 when the 29 that indicated extra costs are combined with the 32 that indicated *no* cost ($0). The overall median drops from $1000 for all respondents who answered yes to additional costs to $425 when respondents indicating no cost ($0) are included. Ten percent thought it might cost $2000 to $3500 more, while 10% of the group indicating some additional cost thought it might be as low as $400.

The question also invited respondents to indicate why these costs would be incurred. The comments are included in Appendix G. Increased equipment size was indicated by 43 respondents, with one indicating simply, “Larger system means larger duct work, means more expensive.” Another 19 respondents indicated a whole-house dehumidifier or a different system type to deal with the humidity would be needed as in this response, “To do this in our humid climate would necessitate a two-stage outdoor unit, or a dehumidifier added to the central system.”

Ability and availability to conduct blower door testing

Having obtained estimated costs for the example home, the next section of the survey inquired as to the person’s anticipated FUTURE blower door testing and whole-house mechanical ventilation system installations. The first question in this section was “If blower door testing is required in the FUTURE, who would you expect to offer blower door testing (select all that apply)?” As shown in Figure 14, over 50% of respondents indicated *energy raters* and over 50% also indicated *HVAC contractors*. Some respondents wrote in detailed answers such as the following, “Those who have taken and passed a course on blower door testing, and who are somehow regulated--ie: DBPR, CILB or BPI, RESNET.” One respondent was rather cynical, “crooks, thieves and liars.”

The responses were almost split to a question posing “If blower door testing is required in the FUTURE, do you or your company intend to conduct or offer blower door testing services?” Of the 309 respondents, 54% said *no* and 46% said *yes*. Those answering *yes* had follow-on questions.



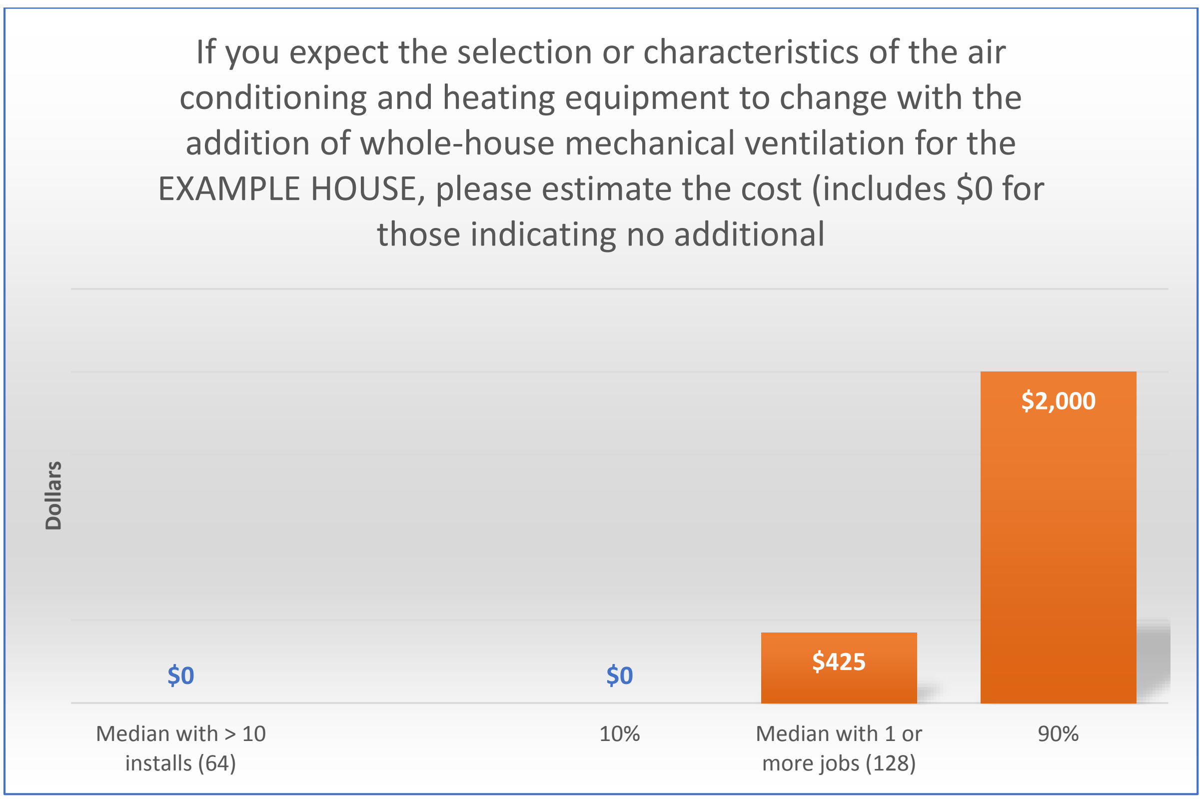


Figure 13. Estimated costs to air conditioning and heating systems with addition of whole-house mechanical system -with those indicating some cost (top) and those indicating no cost as well as those indicating cost (bottom).

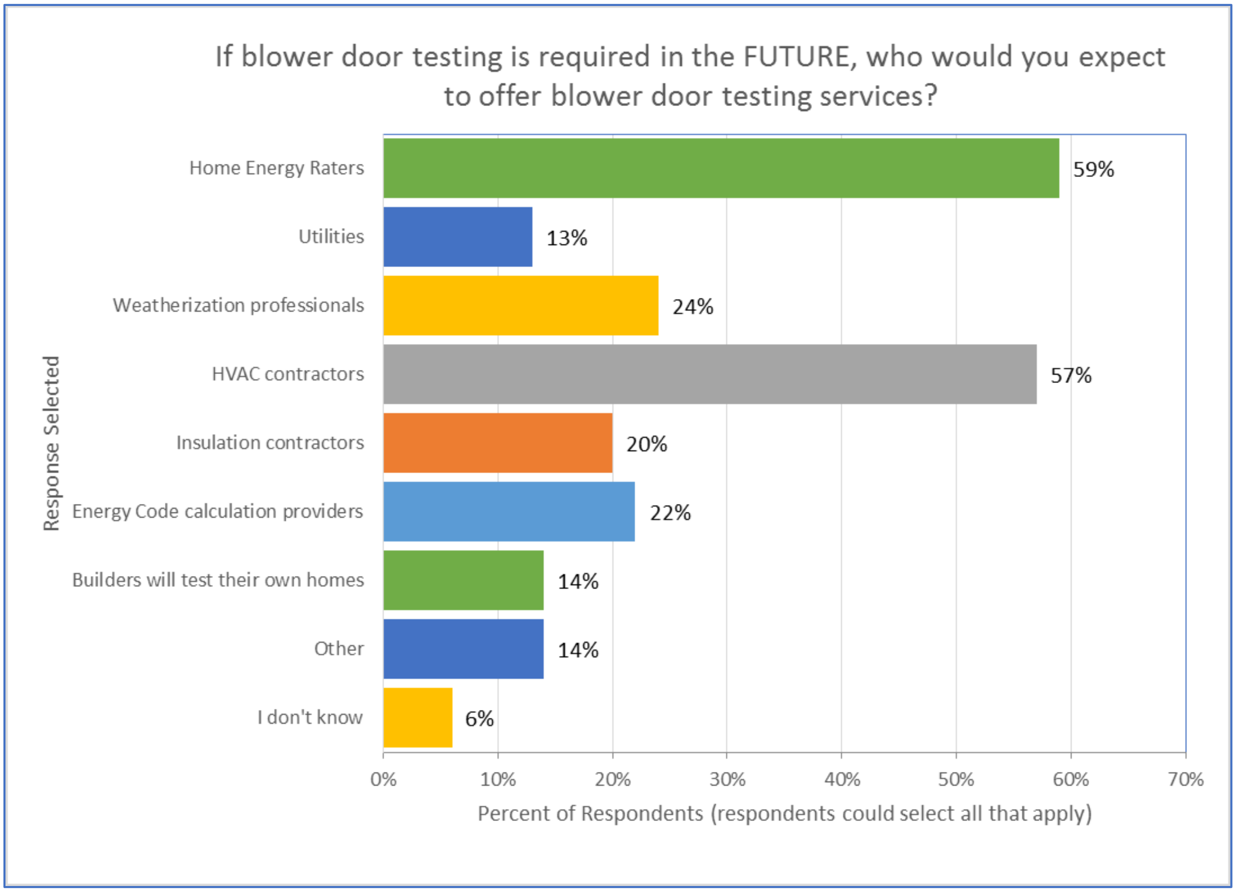


Figure 14. Expected providers of blower door testing services.

Seventy percent (99) of the 141 respondents answered *yes* to this question, "Have you or your company already acquired training to conduct blower door testing?" Those answering yes were asked "Which of the following best describes the type of training you received to conduct blower door testing?" Of the 98 answering that question, 83% indicated having gone through a *certification program*, 10% selected *Industry association training* while 5% indicated *self-study* and 2% responded *Other*.

Some stakeholders have expressed concerns about the capacity of the current testing industry in Florida to meet the demand created by implementation of required testing. The next follow-on question to those indicating they or their company intend to conduct blower door testing services was "If there were no changes in your current capacity and work load, estimate the number of additional blower door tests you could conduct annually within your normal service area." Of the 128 respondents, only 12 answered "0". As shown in Figure 15, the median additional capacity was 500 tests per year among the experienced respondents (those with more than 20 tests in the past two years); for those with some experience it was 250 tests.

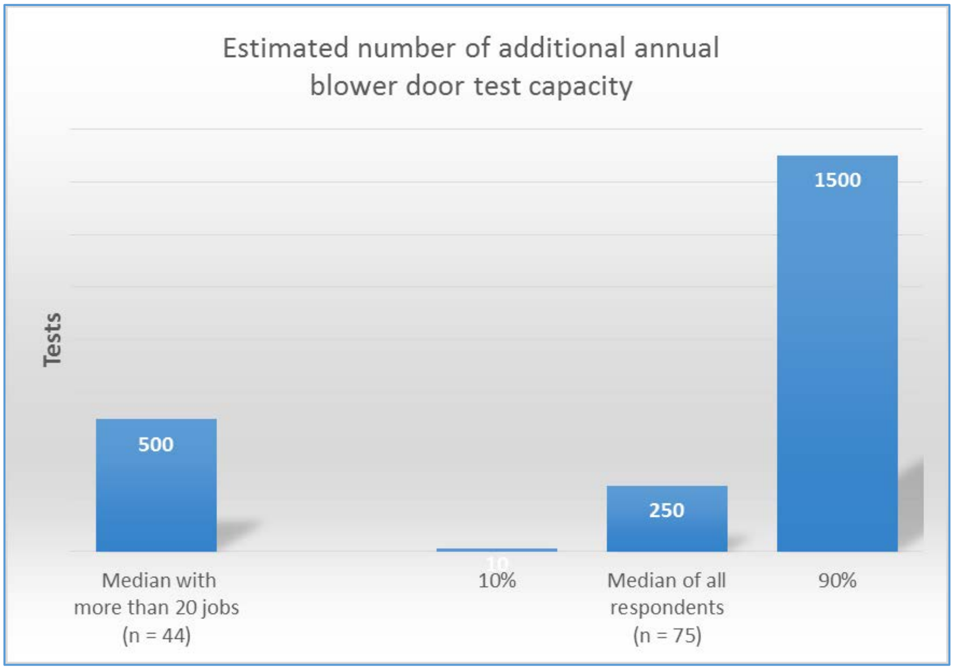


Figure 15. Number of additional blower door tests that could be conducted annually by those already or planning to provide these services in Florida.

Six choices were offered to those indicating they conduct or plan to conduct blower door testing when asked "What resources would you need to double the number of blower door tests annually (select all that apply)?" *Additional personnel* and *additional equipment* were selected by 67% and 62% of the respondents, respectively. *Additional training* was selected by 28%, *Nothing* was selected by only 12%. *I don't know* was selected by 6% and *Other* was selected by 7.5% of the 138 respondents answering the question. One person selecting *Other* wrote "more available jobs."

Ability and Availability to Install Future Whole House Mechanical Ventilation Systems

The next section of the survey inquired about availability of those who indicated one or more experiences installing whole house mechanical ventilation systems in the current marketplace. The first question was "If whole-house mechanical ventilation is required in the FUTURE, will you or your company be involved in specifying such systems?" Of the 318 respondents, 198 (62%) said *yes* and 120 (38%) responded *no*.

Those answering *yes* received the following question, "What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to comply with Florida Code requirements if/when the legislative delay ends (select all that apply)?" Answers are shown in Figure 16. The answer *Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)* was selected by 50%, *HRV (heat recovery ventilator) or ERV (energy recovery ventilator)* by 33%, *Exhaust only (excluding occupant controlled kitchen and bathroom fans)* by 25% and *I don't know* by 8%. *Other* was selected by 15% of the 196 respondents. Comments by those selecting *Other* included, "Balanced with exhaust fans and damper to allow for fresh air, so basically a balanced system" and "Depends on the location dewpoint temperature, type of construction, habitability and typical air infiltration rates expected."

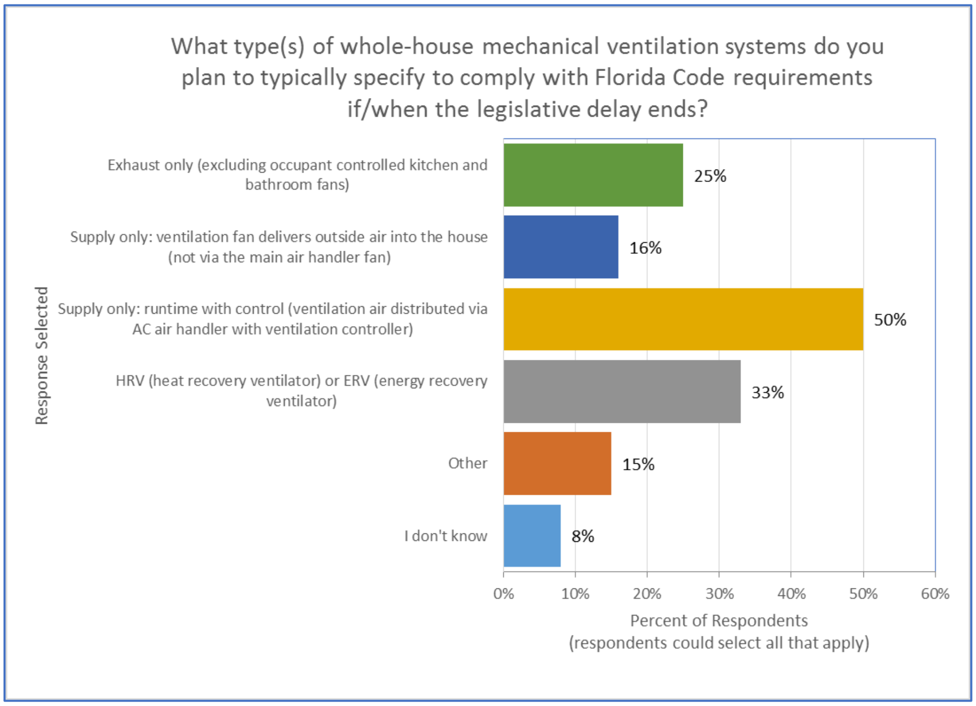


Figure 16. Types of whole-house mechanical ventilation systems expected to be typically specify by those respondents with one or more experiences with whole house mechanical ventilation.

There were 131 write-in responses to the follow-up question, "Why would you specify this/these types?" These responses are tabulated along with the system type selected in Appendix G. One person wrote "Cheaper than the right way (which is a dehumidifier)" while another wrote "To keep a slight positive pressure in the house. We don't want a negative pressure in the house which would suck humid air into the walls which would cause mold and be an energy penalty. We want to dehumidify the incoming air with the air handler or an ERV."

There were 171 responses to another related question, "Are there any types of whole-house mechanical ventilation system you would not specify to comply with the Florida Code requirement?" While 61 respondents (36%) selected *I don't know*, 72 (42%) indicated *Yes* and just 38 indicated *No* (22%). Those answering *yes* were encouraged to "please describe which system(s) you would not specify and why." All answers are in Appendix G and include "Systems which involve putting untreated air directly into the living space or into the air handler. Both of these options have side effects that builders and homeowners will not tolerate, except for the price for being code compliant." Another indicated "I would discourage any system that uses the air handler blower to distribute air due to energy costs involved in using such a large blower to move a very small amount of air."

Experience Over the Last Two Years with Air Sealing and Blower Doors

The survey takers with one or more blower door testing experiences were asked about the results they had experienced over the last two years and to estimate results based on that experience.

They were asked to "Please complete the table below for the blower door tests you have conducted or had conducted for new Florida homes over the PAST TWO YEARS." Table 7 shows the table they were asked to complete and Table 8 indicates the median response among those with one or more experiences.

*Table 7. Format of question requesting typical air sealing and blower door typical values based on last two years of experience "Please complete the table below for the blower door tests you have conducted or had conducted for new Florida homes over the PAST TWO YEARS. *Note: If the blower door test was part of a larger scope of work, please estimate what it would have cost the builder to have only a blower door test and the associated reporting."*

	% of Total Blower Door Tests Conducted (%)	*Approximate Average ACH50?*	*Approximate Average Cost to Builder for Blower Door Testing ($)*
Tested for ENERGY STAR or other program certification			
Tested for optional Florida Energy Code (performance path credit or envelope tightness demonstration)			
All others			

Table 8. Median Average ACH50, and Median Average Cost to Builder by ENERGY STAR and Other Programs, Florida Energy Code, and All Others based on last two years of experience

Median of all Experienced Respondents	Percent of Total Blower Door Tests Conducted (%)	Approximate Average ACH50	Approximate Average Cost to Builder for Blower Door Testing ($)
Tested for ENERGY STAR or other program certification	n/a	3.8 n=52	$250 n=63
Tested for optional Florida Energy Code (performance path credit or envelope tightness demonstration)	n/a	4.0 n=36	$250 n=42
All others	n/a	5.0 n=35	$300 n=40

Unfortunately, the goal of having the respondent indicate what percentage of the homes they had tested were done for one of the three categories was not achieved. It appears that respondents interpreted that question in different ways as their answers don't sum to anywhere close to 100%. The approximated ACH50 was generally slightly lower for ENERGY STAR and other program certification homes than it was for Florida code homes, with medians of 3.8 and 4.0 ACH 50, respectively. The median cost to the builder for blower door test was $250 for both the ENERGY STAR and Florida Code categories, while slightly higher at $300 for all other tests. Figures 17 and 18 graphically illustrate response for the median, as well as the value representing the 10% lowest and 90% lowest response for blower door test results and the average cost to builder to conduct the test.

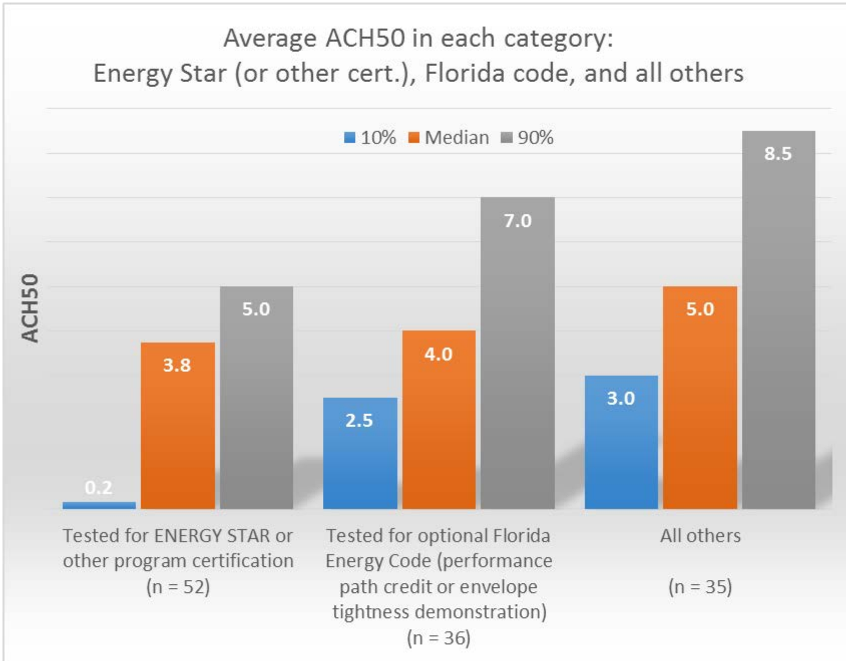


Figure 17. Average blower door test results for Energy Star and other programs, Florida energy code, and all others.

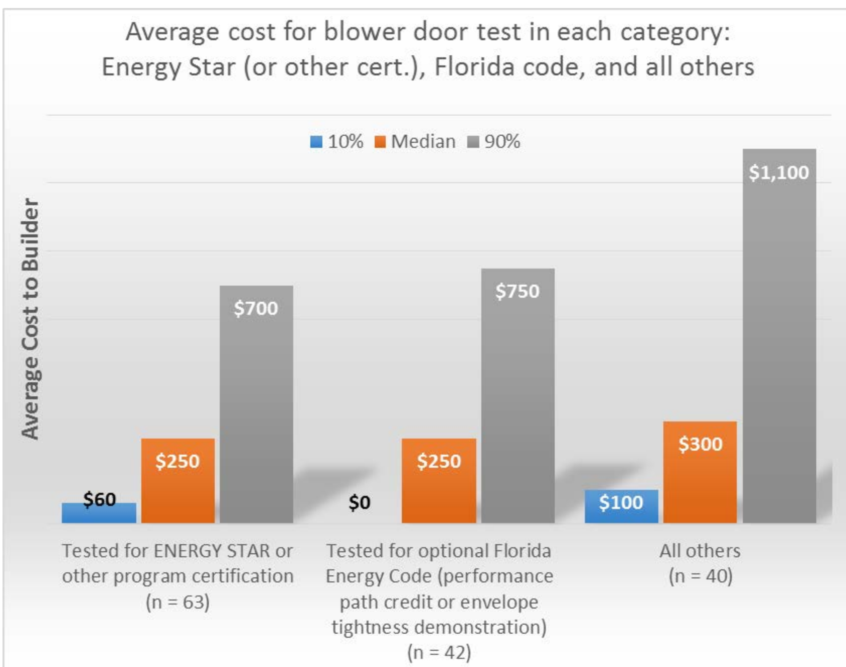


Figure 18. Average cost to builder for blower door tests conducted for Energy Star and other programs, Florida energy code, and all others.

The next question asked what ACH50 they would expect for a new code home. They were presented with six choices: Four ranges of ACH50, *I don't know* and *Comments.* In this case, the person selecting *Comments* could not also select an ACH50 range. As shown in Figure 19, 44% thought the ACH50 would likely be in the 3.1 to 6 range and another 13% expect tightness of 3 or less. Only 2% thought the houses would be higher than ACH50 of 9, however there were 17% selecting *I don't know* and 15% selecting *Comments*. Those selecting comments (all are given in Appendix G) had some thoughts on when and how this value may differ. One comprehensive comment was "I think below 5 is a good starting point for builders. Most of the new homes I tested were builder wanting to know how tight their house was and how then can get to under 5 ACH50. The majority of the houses that didn't meet 5 ACH50 were because contractors made penetrations through the building thermal envelope and did not seal the penetrations, air barrier was not continuous, and parts of the house were missing insulation or were not air sealed. On the other end some of the houses I have tested were under 2 ACH50. Houses like this really need outside [air] and the only [way] you can possibly know is to test the house."

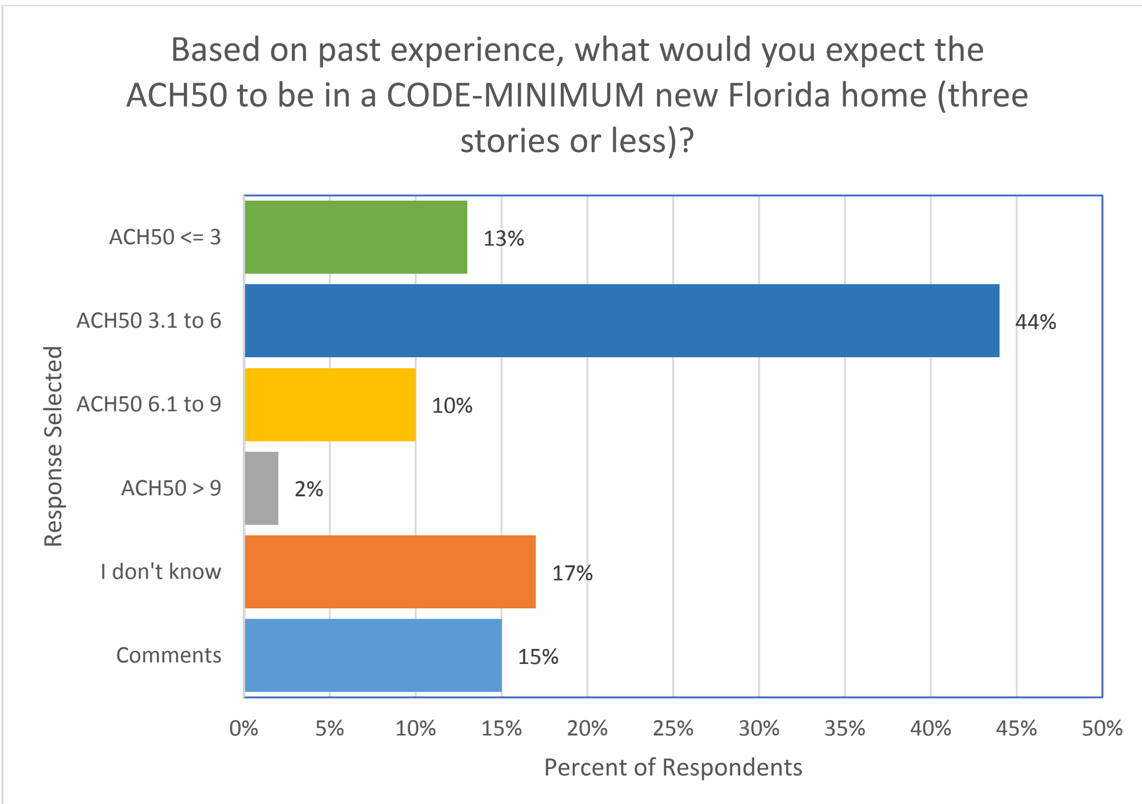


Figure 19. The expected ACH50 value of code-minimum homes

The next question asked about job site delays: "In the PAST TWO YEARS, have you ever had a building delay of three or more days due to unavailability of house tightness testing personnel?" Eighty-nine out of the 107 respondents or 83% indicated *no* while eighteen or 17% responded *yes*. Of the 18 responding yes, 4 indicated having delays 90 to 100% of the times testing was done, while 8 indicated that it was 10% or less of those times that there were delays of that length. Four others indicated 20% -45% of their experience was delayed by three or more days, while 2 others thought it was about half the time.

The 18 respondents who indicated they experienced delays of three days or more were also asked "What cost ($), if any, do you associate with a delay of three days in getting a test completed?" The range was $0 to $6000 from 15 people answering. Seven respondents indicated it would cost $1000 to $3000, with 2 indicating such a delay would cost $5000 - $6000. Two others thought it would be $0 -$50 and 4 respondents estimated between $500 and $650. The median of these fifteen responses was $1200.

Experience Over the Last Two Years with Whole House Mechanical Ventilation Systems

The survey tool was also designed to solicit typical cost over the past two years for whole-house mechanical ventilation systems. Respondents were instructed "Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems you have installed in new Florida homes over the PAST TWO YEARS and estimate the average cost for each type." Table 9 shows the format of the question and Table 10 provides the medians for the inputs requested.[7]

Table 9. Format of question requesting typical whole-house mechanical ventilation installations values based on last two years of experience "Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems you have installed in new Florida homes over the PAST TWO YEARS and estimate the average cost for each type."

	% of Total Installs (%)	*Approx. Average Cost to Builder Including Installation ($)*
Exhaust only (excluding occupant controlled kitchen and bathroom fans)		
Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)		
Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)		
Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)		
HRV (heat recovery ventilator) or ERV (energy recovery ventilator)		
Default - Other, please describe:		

[7] Some respondents only partially completed the table, ignoring some ventilation types.

Table 10. Median Percentage and Cost by Type of Whole-House Mechanical Ventilation System

Median Response for All Respondents with Any Experience	Percent of Total Installs (%)	Approximate Average Cost to Builder Including Installation ($)
Exhaust only (excluding occupant controlled kitchen and bathroom fans)	40 n = 20	$400 n = 23
Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	8 n = 9	$880 n = 9
Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)	25 n = 26	$400 n = 26
Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	70 n = 29	$350 n = 28
HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	20 n = 21	$2000 n = 23
Default - Other, please describe:	33 n = 8	$2800 n = 9

The median, 10th and 90th percentile of responses for cost of each type are illustrated in Figure 20. The median cost for exhaust only (the ventilation type with the second-highest percent of installs) was $400 and ranged from $150 and $1,500 between the 10th and 90th percentiles. Much larger was the cost range for supply only with runtime control (the highest ranking ventilation type for percent installed), which had a median reported cost of $350 but ranged from $100 to $6,500 between the 10th and 90th percentiles.

Questions were asked about delays caused by whole-house mechanical ventilation system installations with this question: "In the PAST TWO YEARS, have you ever had a building delay of three days or more related to whole house mechanical ventilation installation?" Seventy-eight percent of the 129 respondents indicated *no* while 22% selected *yes*. The 29 respondents who answered *yes* were asked "What percent (%) of time were delays of three or more days experienced?" Only 24 people answered the question; seven indicated it happened from 1 to 10% of the times they experienced delays, four indicated 100% of the time, one wrote 75% of the time, two wrote 20%, and one wrote 40%. The most popular answer was 50% of the time, as written by eight respondents. The median was 50% as well.

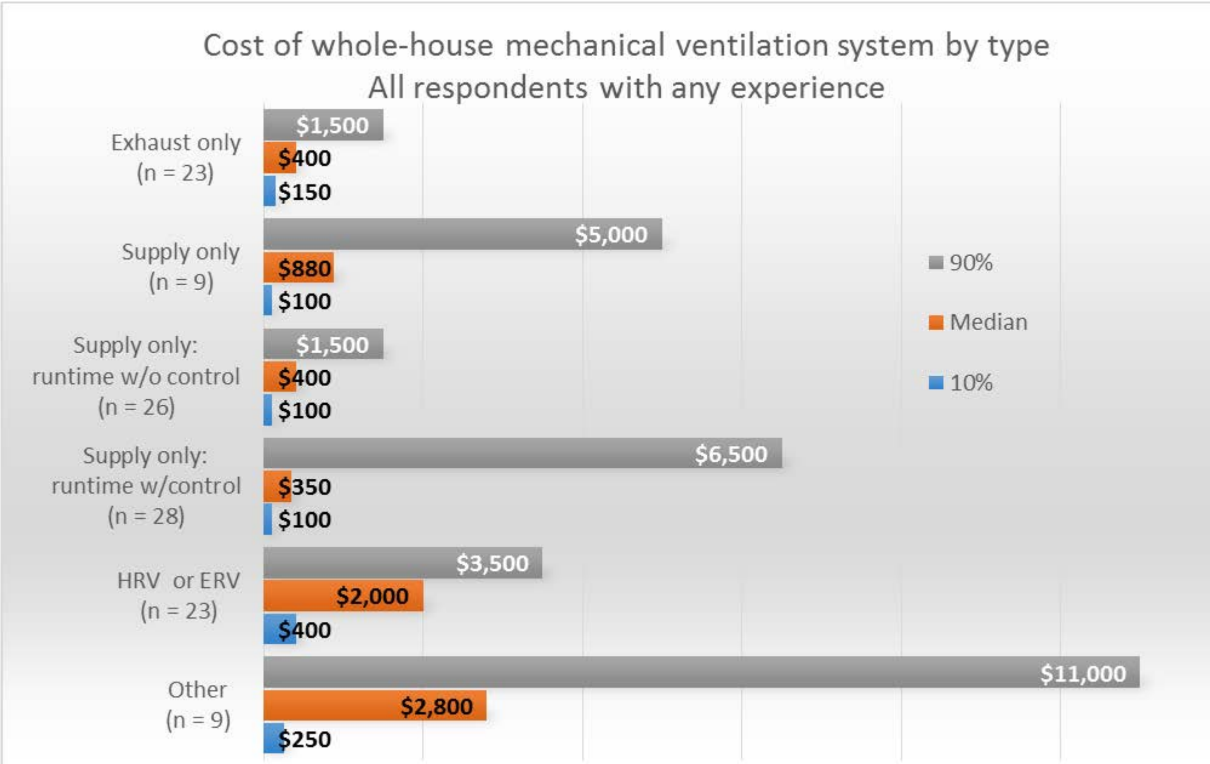


Figure 20. The median, 10th and 90th percentile of responses for cost of each type of whole house mechanical ventilation system

This group of 29 who answered *yes* to long building delays were also asked "What cost ($), if any, do you associate with a delay of three days in mechanical ventilation installation?" Note that this answer is slightly different than the delay for blower door as there are different respondents. There were three people indicating $0, and at the high end one respondent wrote $15,000 and another $6000. There were another ten people writing in numbers between $120 and $900. Three wrote $1000 and six indicated $1500 to $3000. The range of answers may reflect both attitude towards delays as well as the potentially different price points of housing. The median was $900.

Because houses in the past two years have not required ventilation strictly from Florida building code, the question was asked "Why were the whole-house mechanical ventilation systems installed (select all that apply)?" The percentage breakdown of the 142 responses is shown in Figure 21. Each of the three reasons were chosen by over 30% of respondents.

Among the 32 writing in *other* responses (See all in Appendix G) were these reasons:

- "We believe they are a worthwhile investment for the health of the population and educate homeowners. All the VOC's release in a home from products we buy, mainly from overseas, go in to our bodies. Have you ever wondered why cancer has escalated in our country?"
- "None required. Waste of money. Waste of time. Governmental interference."
- "LEED and FGBC certifications."
- "Recommended by us."
- "Air exchange in homes with sealed attics."

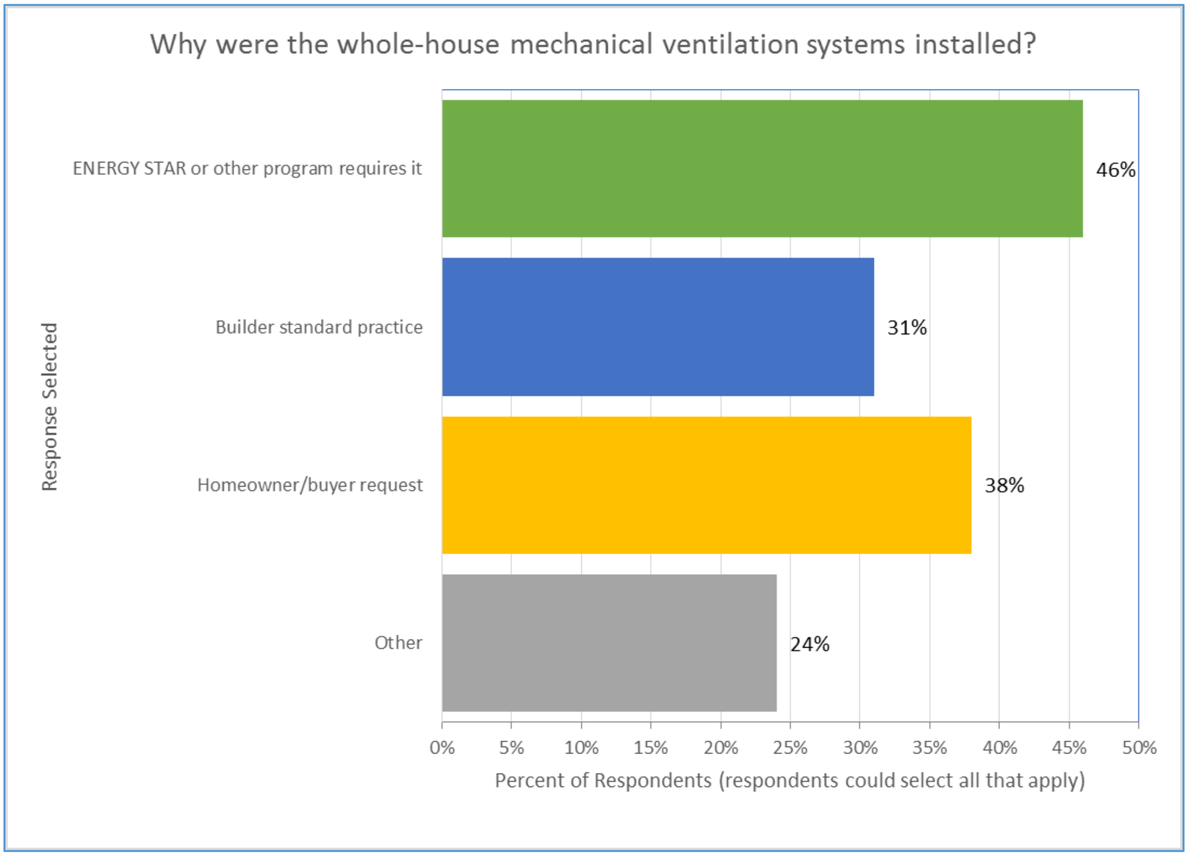


Figure 21. Why mechanical ventilation systems were installed in houses over the last two years

Most recent air sealing and blower door testing experience

Earlier we have described the work background and experience of the respondents, the example home responses, their future plans, and in the last section, their typical experience. As a final method of obtaining data, the survey takers were asked information about their last residential job. Because jobs vary significantly in size, a number of questions were asked about the job. This section was purposely put at the end in case some participants did not want to research in their records for the information or felt that somehow they would be identified through divulging this information. They could exit the survey and the rest of their responses would still be saved.

The first question in this section of the survey was "*Considering only YOUR MOST RECENT blower door test in a new Florida home (three stories or less), even if it was not typical of your work, please provide the following. Note: If the blower door test was part of a larger scope of work, please estimate what it would have cost the builder to have only a blower door test and the associated reporting.*" Table 11 shows the inputs available and Table 12 is a summary of responses for the inputs requested, including size, number of bedrooms, airtightness test results, and builder cost. As this table and Figure 22 show, the median ACH50 was 4.0 for both the overall and the experienced group; the mean average of the overall group was 4.0 likewise.

Table 11. Format of question regarding the most recent blower door test, "Considering only YOUR MOST RECENT blower door test in a new Florida home (three stories or less), even if it was not typical of your work, please provide the following. Note: If the blower door test was part of a larger scope of work, please estimate what it would have cost the builder to have only a blower door test and the associated reporting."

	Month	Year	Approximate Conditioned Area (ft^2)	Number of Bedrooms	Approximate ACH50 test result	Approximate cost to builder ($)
Most recent blower door test						

Table 12. Most Recent Blower Door Test Results by Conditioned Area, Number of Bedrooms, ACH50, and Builder Cost

Most Recent Blower Door Tests Conducted	Approximate Area (Ft^2)	Number of Bedrooms	Approximate ACH50	Approximate Cost to Builder
Median of respondents with > 20 jobs	2200	4.0	4.0	$250
	n=43	n=43	n=39	n=41
10% estimate of all respondents	1250	3.0	2.0	$113
	n=81	n=81	n=72	n=80
Median of all respondents	2200	4.0	4.0	$300
	n=81	n=81	n=72	n=80
90% estimate of all respondents	4000	5.0	6.5	$1,200
	n=81	n=81	n=72	n=80

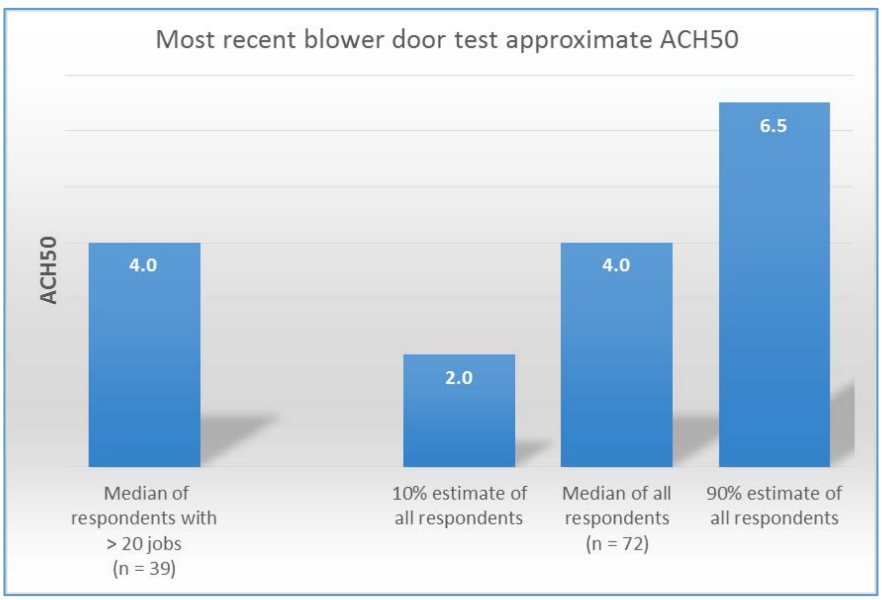


Figure 22. ACH50 for most recent blower door test conducted.

The median cost for the experienced groups was \$250 and for the overall response, \$300. This agrees strongly with costs predicted and reported in other parts of the survey. Ten percent indicated cost of \$113 or less and 10% indicated cost of \$1200 or more as shown in Figure 23. Table 13 delineates costs into four general home sizes and generally suggests a relationship between living area and blower door cost. A simple linear regression confirms this positive relationship between the square footage and the cost, with blower door cost = 162.76 + (0.1366 * Area) (p<0.01), suggesting a cost of \$299 for a 1000 ft^2 home and a cost of \$572 for a 3000 ft^2 home.

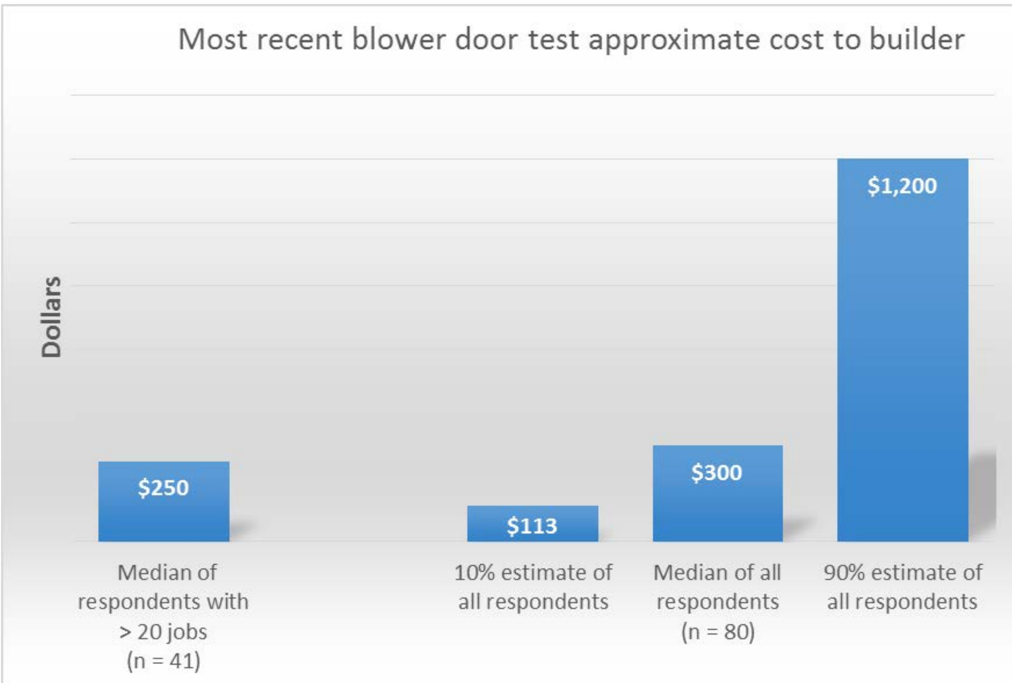


Figure 23. Costs of most recent blower door testing

Table 13. Median Blower Door Cost on Most Recent Job by Home Size Category

Approximate Cost to Builder for Most Recent Blower Door Tests Conducted	< = 1500 Ft2	1501 - 2500 Ft^2	2501 - 3500 Ft^2	3501 - 8000 Ft^2
Median of respondents with > 20 jobs	\$350	\$250	\$225	\$500
	n=3	n=25	n=8	n=5
Median of all respondents	\$300	\$250	\$400	\$475
	n=11	n=39	n=17	n=12

The follow-up question was "*Why was YOUR MOST RECENT blower door test conducted (select all that apply)?*" Figure 24 shows the responses.

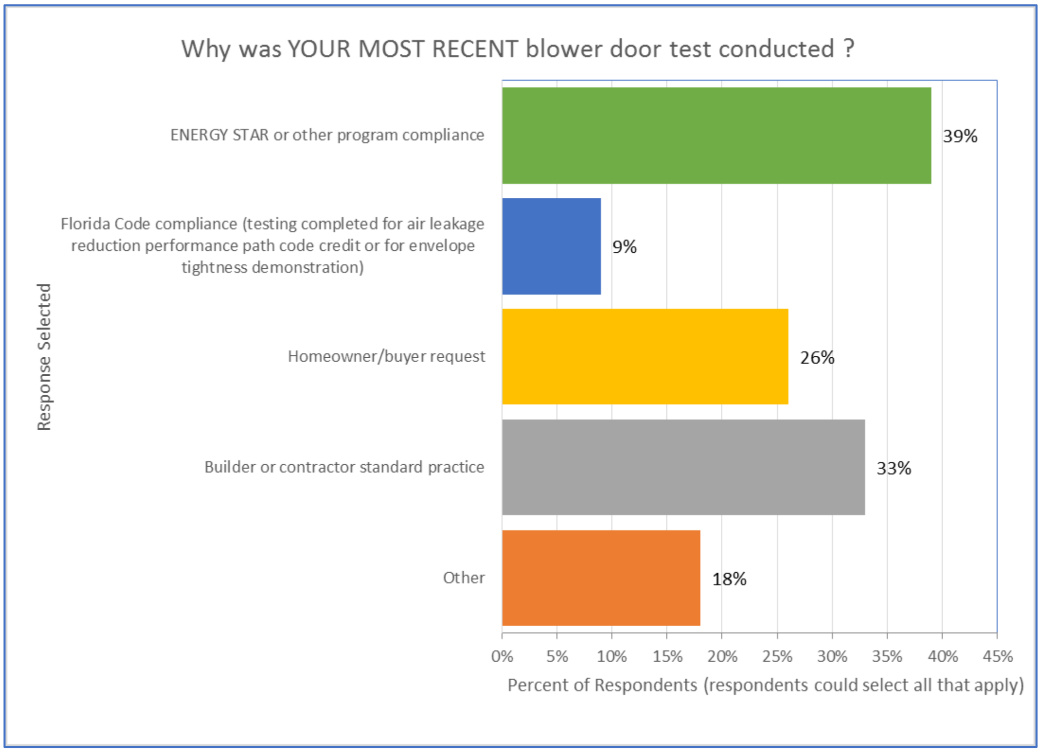


Figure 24. Reason for conducting a blower door test on the most recent home

ENERGY STAR or other program compliance was the most popular response with 39%. Some of the comments received from those 19 respondents selecting *Other* included "This builder was building his personal home and *wanted to make sure everything was done correctly* he had just recently changed insulation contractors because of the lack of quality the previous company was showing. He also wanted to make sure that his fireplace wasn't going to vent the gases back into his house like at his previous residence and request that the mechanical contractor added fresh air." Another interesting response was "Mechanical Engineer recommended the test to determine source of moisture entering the space."

Most recent whole house mechanical ventilation installation experience

Similar to the blower door testing, several questions were focused on the most recent whole-house mechanical ventilation system installation. The question format is shown in Table 14 and the results in Table 15 for "*Considering only YOUR MOST RECENT whole-house mechanical ventilation system installation in a new Florida home (three stories or less), even if it was not typical of your work, please provide the following. Note: If the whole-house mechanical ventilation system was part of a larger scope of work, please estimate the cost to the builder for only the whole-house mechanical ventilation system.*"

Table 14. Format of question asking "Considering only YOUR MOST RECENT whole-house mechanical ventilation system installation in a new Florida home (three stories or less),even if it was not typical of your work, please provide the following."

	Month	Year	Approximate Conditioned Area (ft^2)	Number of Bedrooms	Approximate outside airflow (CFM)	Approximate cost to builder ($)
Most recent whole-house mechanical ventilation system install						

Table 15 shows the median responses and number of respondents (n) for each piece of information requested.

Table 15. Median Responses to the Requested Information about the Most Recent Whole-House Mechanical Ventilation Installation Experience

Most Recent Whole-House Mechanical Ventilation System Installed	Approximate Area (Ft^2)	Number of Bedrooms	Approximate Outside Airflow (CFM)	Approximate Cost to Builder
Median of respondents with > 10 jobs	2410	3.0	69	$365
	n=38	n=38	n=30	n=36
10% estimate of all respondents	1400	3.0	5	$150
	n=65	n=65	n=52	n=63
Median of all respondents	2500	4.0	80	$1,200
	n=65	n=65	n=52	n=63
90% estimate of all respondents	5000	5.0	200	$8,000
	n=65	n=65	n=52	n=63

The median cost for the experienced group (36 answering) was $365 and for the overall response, $1200 (63 answering) for this last installation. Our 2000 square foot example home was $500 and $800 median values for the two groups. Ten percent indicated it cost $150 or less and 10% indicated it cost $8000 or more as shown in Figure 25. A simple linear regression found a positive relationship between the square footage and the cost. Excluding the four most expensive installations (which exceeded $10,000) for the purpose of producing a projection, the linear regression found that cost was equal to 89.523 + (0.5672 * Area) (p<0.01). The model suggests a cost of $657 for a 1000 ft^2 home and a cost of $1791 for a 3000 ft^2 home, somewhat consistent with the median of $1200. The mean average ventilation air flow rate was 114 cfm and the median was 80 cfm for those with more than 10 installations. The median for the overall experienced group was 69 cfm as shown in Figure 26.

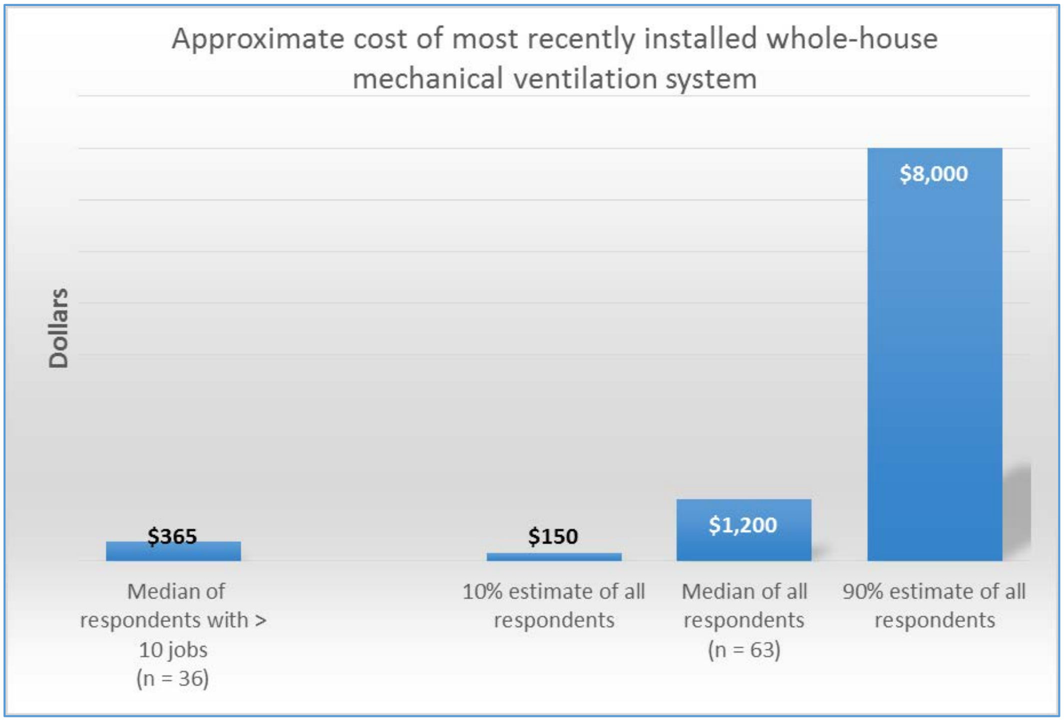


Figure 25. The cost of the mechanical ventilation system on the most recent house that was worked on There were 36 with 10 or more jobs of experience answering and 63 total respondents.

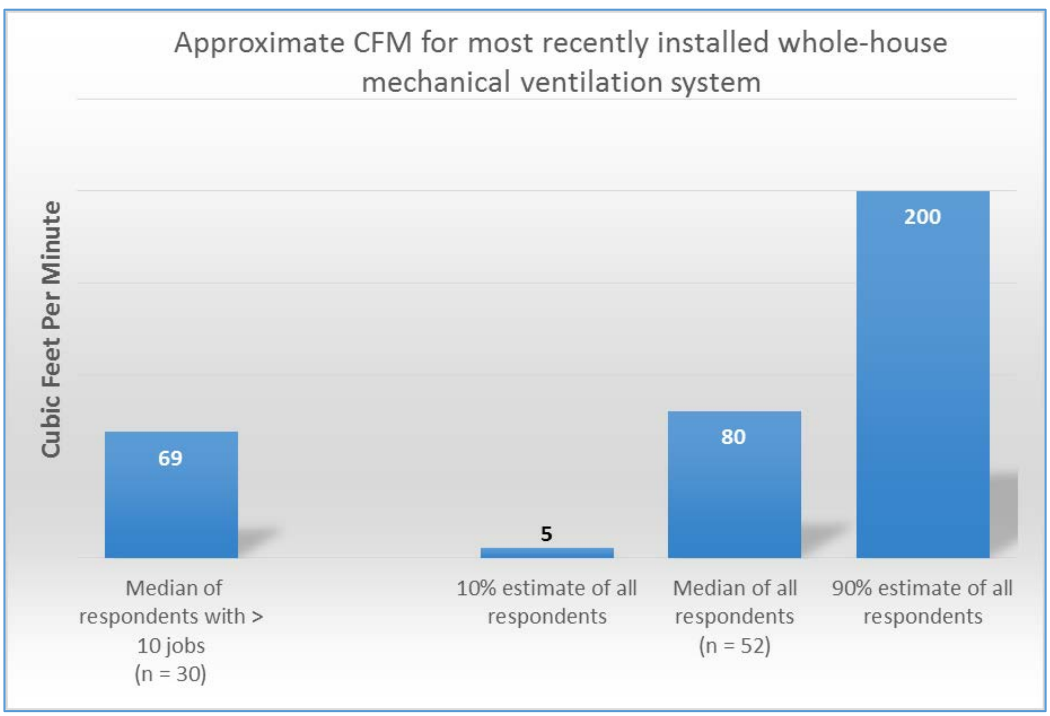


Figure 26. Median CFM for most recently installed whole-house mechanical ventilation system.

There was no clear consensus again to the follow-up question regarding the type of system installed: “What type of system was YOUR MOST RECENT whole-house mechanical ventilation system?” *Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)* was the most popular selection with 27% as shown in Figure 27.

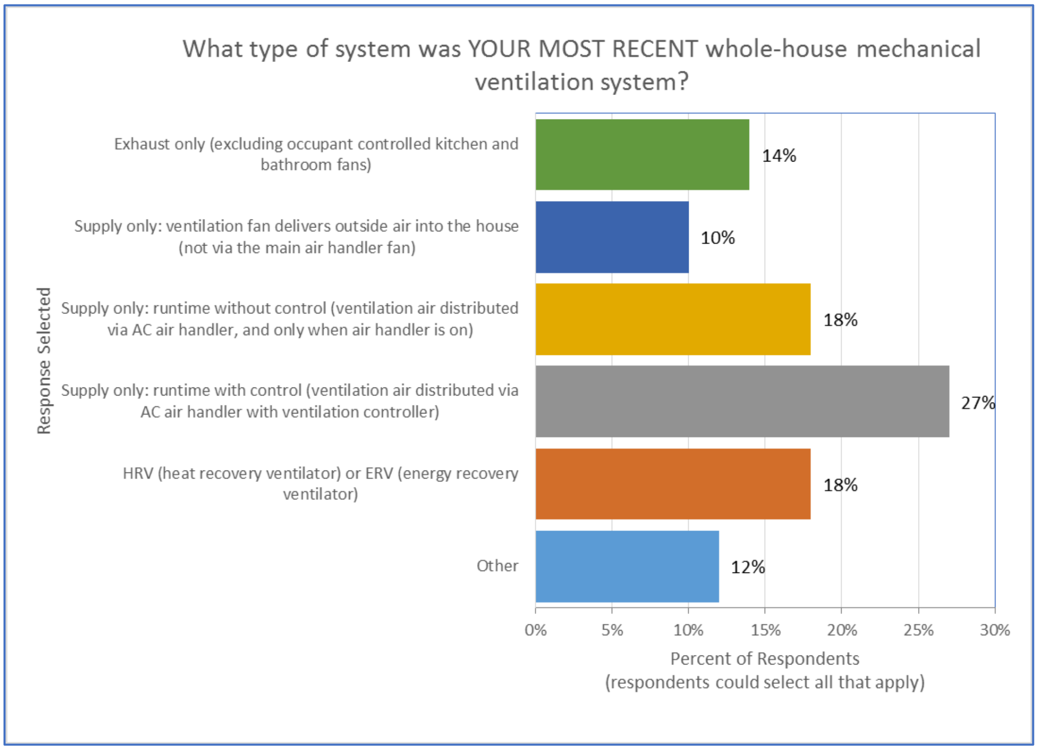


Figure 27. Most recent type of whole-house mechanical ventilation system installed.

A third of the 12 respondents selecting *Other* described a dehumidification system. One respondent was very detailed, “A dehumidifier with a flex line and damper to the outside was installed as well as a bath fan timer to have an 80cfm bath ran fun for 15 minutes out of every hour. The advantage of the dehumidifier is that it can dehumidify the home without bringing the outdoor compressor on and it can work separately to bring in outside air and dehumidify that air without bringing the unit on.”

Similar to other parts of the survey, the next question was focused on the reason for the system installation: “*Why was YOUR MOST RECENT whole-house mechanical ventilation system included in this home (select all that apply)?*” *ENERGY STAR or other program requires it* was the most popular answer with 34% of respondents selecting it (See Figure 28). *Homeowner/buyer’s request* was the next most popular reason suggesting consumer interest is often the motivating factor for the installation.

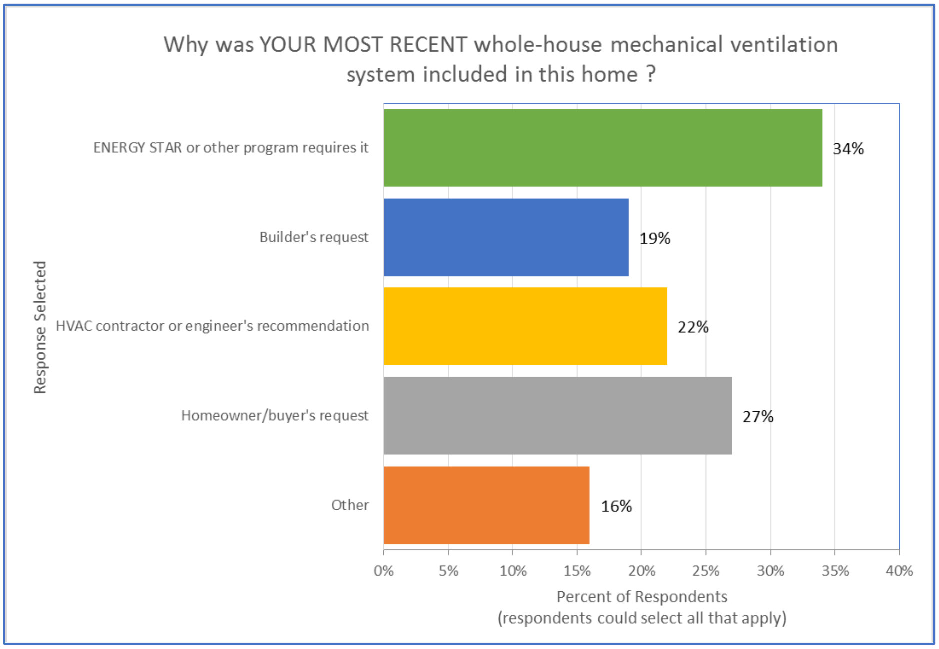


Figure 28. Reason for most recent whole-house mechanical ventilation system installation

A slightly different question was focused on why the specific system was chosen: “Why was this specific whole-house mechanical ventilation system selected (select all that apply)?” *Builder’s choice* (37%) was the most popular answer, closely followed by *HVAC contractor’s choice* (32%) as shown in Figure 29.

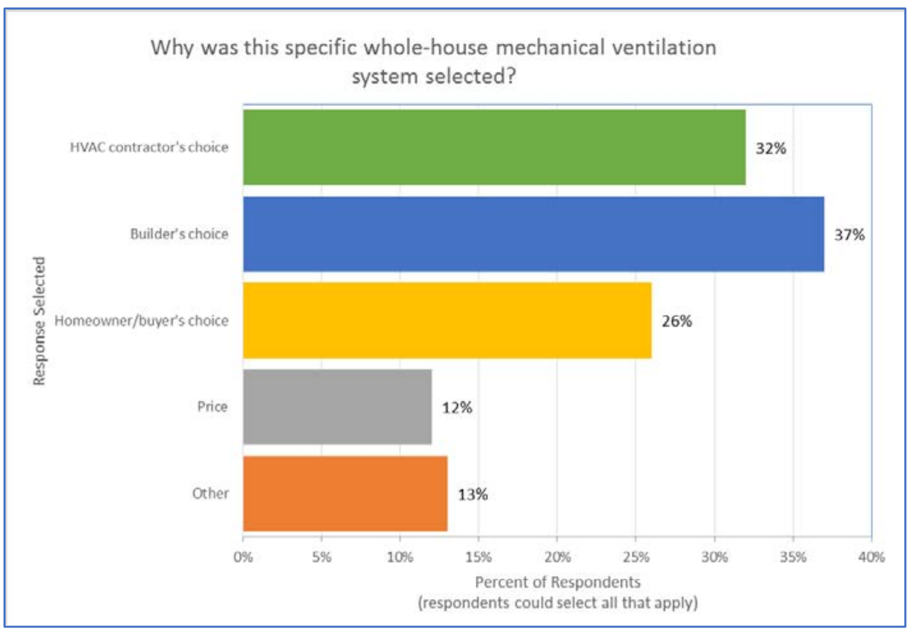


Figure 29. Reason specific whole-house mechanical ventilation system was chosen

Similar to the example house question, there was also information requested about changes to the HVAC system brought about by including whole house mechanical ventilation for the most recent installation: “*Was there any other additional HVAC cost ($) to the builder resulting from* *whole-house mechanical ventilation*?" Fifty-five of 102 respondents (54%) said *no*, and forty-seven (46%) chose *yes*. Of those selecting *yes*, only 34 provided the cost. Of those providing cost who were experienced (>10 installs), the median cost estimate was $880. This drops to $0 if you factor in all the *no* cost ($0) responses. The median for all 34 *yes* responses was $1,250, with 10% indicating $250 or less and 10% indicating $4000 or more. If all the *no* cost ($0) responses are factored in, the 10% and median values are $0 and the 90% value is $2500. These values are shown in Figure 30.

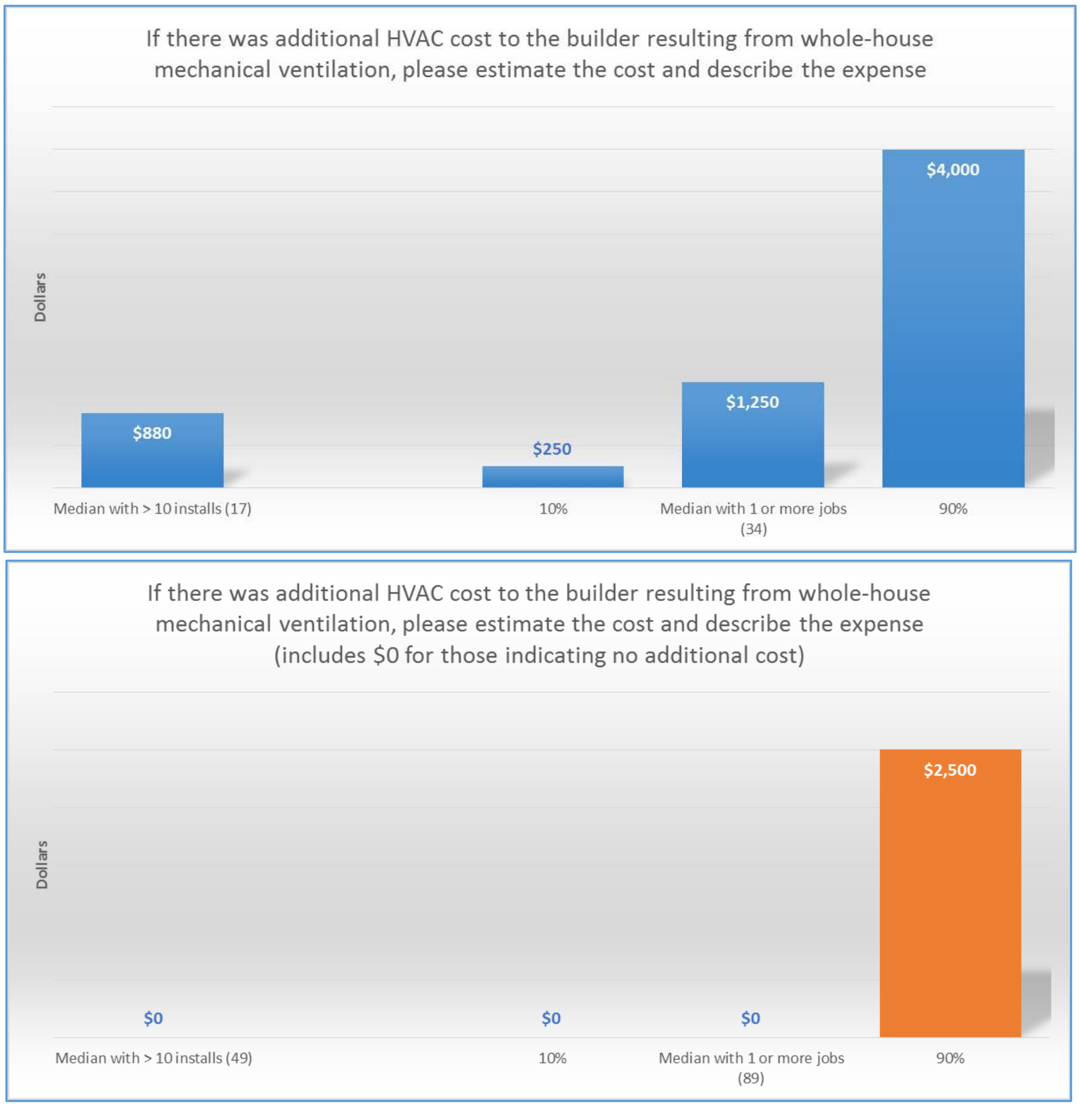


Figure 30. Additional HVAC cost for most recent job due to a whole-house mechanical ventilation system being installed. Top figure is for only those that indicate costs, and bottom figure includes $0 as response for all those indicating no additional cost.

Some of the reasons given for increased HAC costs may have been for items as part of the mechanical ventilation installation as opposed to the intent of the question which was to see if the capacity was increased or dehumidifiers added or other features. For example, some comments for this response included "Time and materials" and "Additional vent into the soffit and passive vent." Others gave specific changes along the lines expected: "Variable speed air handlers, thermostat controls, intake duct and filtration along with control dampers," and

"HVAC controls to operate dehumidification system in different modes, ie., fireplace on, kitchen hood on, elevated space humidity levels, turn off the system while unoccupied, etc." Six responses indicated system sizing increases.

An open-ended question, "Any additional information or comments on YOUR MOST RECENT whole-house mechanical ventilation system?" allowed for further expression and was answered by 25 respondents. One explained their lack of support for residential whole-house ventilation in our climate, "Energy Star should be geographical. Nobody wants to automatically draw humid air into their Florida Home. We told customers to turn them to the off position." Another wrote, "This was and is a complete waste of client money."

Another person was more adamant in their opposition: "I will never do this again. I would rather walk away from a job than deal with the nightmare brought on by whole house ventilation in Florida." A handful wrote of being pleased with their systems, such as this response, "The house preforms well. The customer is able to maintain 75 indoor temperature with 45% relative humidity. Also when the fire place runs the propane smell does not come back into the house."

Overall Benefit of Air Sealing, Blower Door and Whole-House Code Changes

The final questions on the survey were available to all respondents and provided an opportunity to voice opinions and comments. "*Do you anticipate that the Florida Code's blower door testing requirement and the associated whole-house air tightness requirement will be beneficial overall?*" As shown in Figure 31, more thought *no* than *yes*, by a 55% to 45% margin.

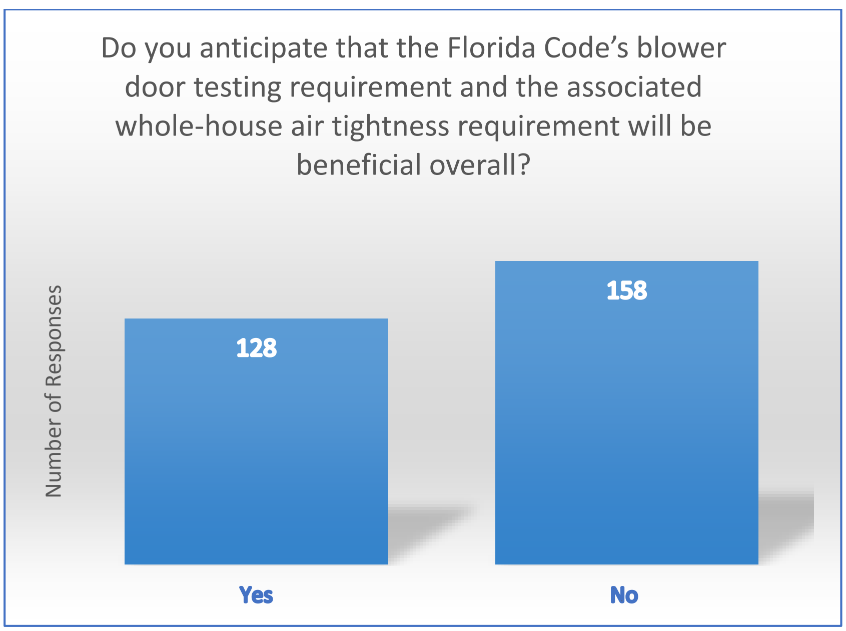


Figure 31. The number of negative responses to overall code change for blower testing and air tightness benefit was 55%, compared to 45% favorable.

An open ended question was given: "*Additional blower door test related comments.*" Ninety three (93) survey takers responded. All answers are provided in Appendix G. Of those responding, 45 comments are of a negative nature. Some of those are directed at the relationship with whole-house ventilation such as this one: "If the house is built so tight you have to use ventilation then you are bringing in the hot humid air the house was built to stop, where is the savings?"

Another 31 comments were generally positive, directed at the need and benefit such as this one: "Blower door testing is needed, to help verify the builder has assembled an energy efficient home poor home owner has no clue about what a blower door test is, but a leaky home is expensive to operate and uncomfortable - to set a standard like *we are gonna build energy efficient homes in Florida by setting the standards (energy code)* BUT - we are not gonna verify the standards are not actually met? - blower door test verifies the envelope is intact, this envelope has too many layers and is only as good as the workmanship during assembly - all done by people - I can tell you many stories of envelopes so poor, indoor moisture content so high - all due to excessive infiltration, driven naturally almost yearlong in our region." Similar but shorter from another respondent: "It is good to test the houses and locate the leaks for repair."

Some respondents stated consequences or solutions, such as this person, "It will take time and require attention to details on the installation of components to achieve a well-sealed house...along with good design." And perhaps the first sentence of the following response is indicating too much code, the rest tries to provide a solution to our climate, "A house would be better if icing was required, then leakage wouldn't be an issue. Another way of increasing energy Efficiency would be to increase the minimum SEER rating of an AC system or heat pump 16 SEER and a two stage compressor. Controlling the humidity in a Florida house is where comfort comes in. A two-stage system will pull more moisture out of a house and allow the homeowner to run the temperature at a higher temp with the same comfort as a house with higher humidity and a lower temperature."

There was a higher percentage, (61%) of respondents who felt the requirement for whole-house mechanical ventilation was not beneficial as shown in Figure XX. There were 80 responses when asked to provide "*Additional whole-house mechanical ventilation related comments.*" Forty two of the comments were generally negative, 21 were generally positive with a number of others either unclear or unresponsive. Some were along the lines of it isn't broke, no need to fix it and this isn't going to help. An example of those responses is "Generally a waste of money. Toilet/kitchen/dryer exhaust can provide that ventilation and has for years without any significant issues. Why fix something that isn't broken." Many were concerned about the potential health consequences of bringing in outside air, such as this response: "BUT! Builder/buyer awareness of proper mechanical ventilation systems is not sufficient. Choosing the least expensive code compliance method will create more public health safety. The amounts of fresh air required through a tight home will create a science experiment inside most air handlers."

Others indicate it can be done successfully such as this response: "I have plenty of experience with mechanical ventilation from the houses I have worked on. When you use an HVAC contractor or engineer that knows how to design the houses properly for our climate zone. You will have no problems. Most of the home owners that I get to educate about ventilation request it. Florida is not the only state that is in Climate zone 2 we face the face the same problems as other South East Costal areas do. If they can make mechanical ventilation work for them. We can also make it work for us. Just as I have with my customers." As with all comment questions in the survey, each answer is included in the appendix.

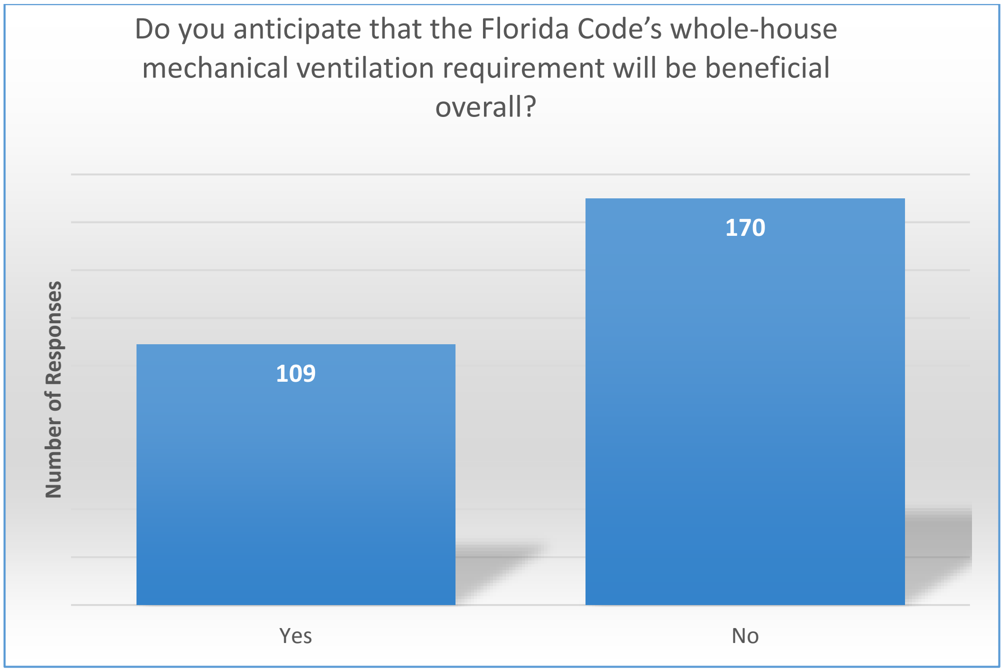


Figure 32. The whole-house mechanical ventilation code change was seen as not beneficial by 61% of people responding.

Testing and Ventilation Code Recommendations

A person having experience with air sealing, blower door testing and whole-house mechanical ventilation systems would have been asked 50 questions on the residential survey, including optional comment questions. As indicated above, there are a number of mixed responses. The cost of the whole-house mechanical ventilation systems is considerably larger than the blower door testing. Also, the negativity and uncertainty of bringing in moisture-laden outdoor air has many concerned of long term consequences.

Many code modification proposals to the Florida Building Commission in 2016 were related to mechanical ventilation and air sealing. Although final decisions for the 2017 code by the Florida Building Commission are still pending the completion of the code adoption process, the Florida legislature, in HB535, did pass legislation addressing the maximum allowable tested air leakage as quoted here:

> *Section 25. Section 553.908, Florida Statutes, is amended to read:*
>
> *553.908 Inspection.—Before construction or renovation is completed, the local enforcement agency shall inspect buildings for compliance with the standards of this*

part. Notwithstanding any other provision of the code or law, effective July 1, 2016, section R402.4.1.2 of the Florida Building Code, 5th Edition 1283 (2014) Energy Conservation, which became effective on June 30, 2015, shall increase the building's or dwelling unit's maximum tested air leakage measure from "not exceeding 5 air changes per hour" to "not exceeding 7 air changes per hour" in Climate Zones 1 and 2. The mandatory blower door testing for residential buildings or dwelling units as contained in section R402.4.1.2 of the Florida Building Code, 5th Edition (2014) Energy Conservation, shall not take effect until July 1, 2017, and shall not apply to construction permitted before July 1, 2017. Additionally, section M401.2 of the Florida Building Code, 5th Edition (2014) Mechanical, and section R303.4 of the Florida Building Code, 5th Edition (2014) Residential, which became effective on June 30, 2015, shall not require mandatory mechanical ventilation unless the air infiltration rate in a dwelling is less than 3 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 Pascals) in accordance with section R402.4.1.2 of the Florida Building Code, 5th *Edition (2014) Energy Conservation.*[8]

The requirement for mandatory blower-door testing was delayed by the Florida legislature until July 1, 2017. HB535 also adjusted the requirement for a whole-house mechanical ventilation system to only apply to homes with less than 3 ACH50, instead of 5 ACH50 as of July 1, 2016.

Pertaining to the delayed code provisions of house tightness testing, house tightness limit, and requirement for whole-house mechanical ventilation, the following recommendations are offered here.

1. House tightness testing is recommended. There is no way to know how tight a home is without measuring it. Visual inspection is limited to the amount of effort as well as the physical ability to access specific areas of construction. Measurement can effectively determine if a specified target has been achieved. Moreover, a test can be one method of determining if there is a portion of the air barrier missing and would avoid houses with extensive air leakage from being built and occupied. The purpose of the code is to set a minimum acceptable level. Very leaky homes will use more energy and potentially have other health or comfort issues. During testing, a smoke pencil can be used to identify areas that need additional air sealing. A large population of qualified individuals are already engaged in this work in Florida, and most certified air tightness testers have capacity to do more. Training centers are in place to train more people and maintain certifications.

2. Allowing whole house air leakage level up to 7 AHC50 is recommended at this time based on recent research examining the current status of installed whole-house mechanical ventilation systems (Sonne et al. 2015). This is leakier than the IECC 2012 requirement of 5 ACH50 for Florida climate zones, and is at the same limit specified in Florida's Building Code 2010, Energy Conservation, Section 402.4.2.1 *Air Leakage Testing Option*. The energy penalty between these two levels is relatively small. Setting

[8] Florida House of Representatives, CS/CS/CS/HB 535, 2016.

a maximum limit at 7 ACH50 may result in most homes at 5 ACH50 or less. As one builder explained at a local HBA meeting, they don't want to fail that test and delay obtaining a certificate of occupancy. An ACH50 of 7 without mechanical ventilation is not, on its own, leaky enough to assure that ASHRAE 62.2 levels of ventilation will be achieved, however it is better to have more natural air exchange if a mechanical ventilation system is not installed or fails.

3. We recommend that whole-house mechanical ventilation systems be installed that are capable of ventilating the home to ASHRAE Standard 62.2-2013. We recommend the code change to use the full standard which allows for credit for natural house infiltration and results in less mechanical ventilation as a house becomes leakier. While we recommend mechanical ventilation, we caution that more guidance and experience is needed for the building industry to gain confidence that homes can be maintained at acceptable humidity and comfort. Case studies exist that demonstrate various methods of mechanical ventilation implemented without humidity issues. That being said, cases can also be made of homes with significant moisture issues believed to be associated with whole house mechanical ventilation. Several variables must be considered such as how ventilation is provided, whether it is pre-treated, where the ventilation air is supplied into the home, type of central cooling system, moisture and thermal barriers, thermostat set points, and variability of internal moisture generation. The reality that about 38 pounds of water may be transported into a home on a typical summer day solely by the ventilation system cannot be ignored. Another 10-12 pounds of moisture may be generated within the home (cooking, bathing, etc.) that also must be removed.

   Florida HB535 has established that whole-house mechanical ventilation be required in homes below 3 ACH50. This at least provides mechanical ventilation for very tight homes. Homes between 3 and 10 (roughly) ACH50 will not meet ASHRAE 62.2 ventilation levels homes without a whole-house mechanical ventilation system and builders should consider ventilation systems.

4. We recommend more research be conducted on whole-house mechanical ventilation systems. Researchers should monitor new technology developments such as:
   - Smart ventilation systems that may control ventilation based on outdoor dew point or other parameters
   - Hybrid systems that use the space conditioning system when operating and supplements with other low energy ventilation systems as needed
   - Small dedicated outdoor systems for conditioning outside air

   Although the work is beyond the scope and mission of the Florida Building Commission, more research is needed to characterize health effects associated with indoor air conditions and pollutants.

Task 3 Access Elevator

Access Elevator Background Research

The literature search included a review of related code modifications from multiple code organizations, including the National Fire Protection Association (NFPA) and the International Code Council (ICC), as well as some local jurisdictions that adopt the ICC family of code. The research also included a review of the history of the requirement, fire related data, and other factors. A summary of that research is provided. Cost data is not very prevalent. Data presented to the FBC had estimates from $770,000 to $1.3 million for structures 12 to 16 stories tall[9].

Overview of Code Requirements

The purpose of having a second fire access elevator in a high-rise building is to facilitate the rapid deployment of firefighters. Firefighters are responsible for assisting in occupant evacuation and fighting the fire. Adding the second fire service access elevator allows them to do both tasks, if needed. Also, if one fire access elevator is out of service, the other one can still be used. Fire access elevator lobbies are required at each level other than the level of exit discharge. The area required for a fire access elevator lobby is 150 sq. ft. One lobby can be used for more than one fire access elevator without having to be enlarged. Fire service elevators (As of the 2015 IBC) need to be able to fit a 24in. by 84in. stretcher. **An additional elevator is not required if the original design contains only one elevator.** Changes that may be necessitated to facilitate the fire service access requirements:

- The building design has to include fire service access elevators that are large enough to accommodate an ambulance stretcher and can hold a minimum of 3,500 pounds
- Emergency lighting along the entire elevator hoistway (lighting may not have to be doubled if it meets the 1 ft.-candle requirement)
- Both elevators must be continuously monitored from the Fire Command Center
- Type 60/Class 2/Level 1 standby source of power for both elevators
- Wiring and cables must be either 2-hr rated CIC or enclosed in 2-hr construction.

IBC Code Changes

Table 1 provides a detail summary of the fire service access elevator (FSAE) requirements per edition of the International Building Code (IBC).

[9] "Amended Petition for Emergency Rulemaking by the Florida Building Commission." June 9, 2015. Accessed July 29, 2015: http://www.floridabuilding.org/fbc/commission/FBC_0615/Commission/Amended_Petition_for_Emergency_Rulemaking_by_the_FBC.pdf

Table 1. Requirements for Fire Service Access Elevators (FSAE) in the IBC

IBC FSAE CODE COMPARISON					
Requirement	2009 IBC	2012 IBC	2015 IBC	Comments	New Cost?
One Fire Service Access Elevator	**X (403.6.1)**	**-**	**-**	Required in buildings with an occupied floor more than 120 ft. above the level of fire department vehicle access.	
Two FSAEs	**-**	**X (403.6.1)**	**X (403.6.1)**	No fewer than two FSAEs, or all elevators, whichever is less. For example, if you only have one elevator for the building you only need one FSAE. Required in buildings with an occupied floor more than 120 feet above the lowest level of fire department vehicle access.	X
FSAE Accommodation of Ambulance Stretcher	**-**	**-**	**X (403.6.1)**	2015: Needs to be both a FSAE and be able to accommodate a stretcher.	X
FSAE Minimum Capacity of 3,500 Pounds	**-**	**X (403.6.1)**	**X (403.6.1)**		X
Phase I Emergency Recall Operation	**X (3003.2)**	**X (3007.2)**	**X (3003.2)**		
Automatic Sprinkler System		**X (3007.3)**	**X (3007.2)**	The building must be equipped with an automatic sprinkler system. The sprinkler shall have a sprinkler control valve supervisory switch and waterflow-initiating device provided for each floor that is monitored by the buildings fire alarm system. 2012: Prohibited locations consist of elevator machine rooms, elevator machine spaces, and elevator hoistways of FSAEs. 2015: Prohibited locations consist of machine rooms, elevator machinery spaces, control rooms, control spaces, and elevator hoistways of FSAEs.	
Water Protection	**-**	**X (3007.4)**	**X (3007.3)**	An approved way to prevent water from entering the hoistway enclosure from the automatic sprinkler system outside the enclosed FSAE lobby.	
Shunt trip	**-**	**X (3007.5)**	**X (3007.4)**	Means for elevator shut down in accordance with 3006.5 shall not be installed on FSAEs.	

Hoistway Enclosure Protection	X (3007.2)	X (3007.6)	X (3007.5)	Refers to Section 708 for exact requirements.	
Structural Integrity of Hoistway Enclosures	-	X (3007.6.1)	X (3007.5.1)		
Hoistway lighting	X (3007.3)	X (3007.6.2)	X (3007.5.2)	Minimum of 1 ft.-candle when the firefighters' emergency operation is active.	
FSAE Lobby Rated Enclosure	X (3007.4.2)	X (3007.7.2)	X (3007.6.2)	1-hr smoke barrier. 2009: Required on all floors except the street level. 2012 & 2015: Required on all floors except the levels of exit discharge.	
Lobby Doorways FSAE Lobby Rated Doorways	X (3007.4.3)	X (3007.7.3)	X (3007.6.3)	¾-hour fire door assembly. 2012: Other than the door to the hoistway. 2015: Other than the doors to the hoistway, elevator control room or elevator control space.	
FSAE Lobby Direct Access to Exit Enclosure	X (3007.4.1)	X (3007.7.1)	X (3007.6.1)	2009: Requires direct access to an "exit enclosure". 2012: Requires direct access to an "enclosure for an interior exit stairway". 2015: Requires direct access to an "enclosure for an interior exit stairway or ramp". Exception through a protected path defined.	
FSAE Lobby Minimum Size of 150 sq. ft.	X (3007.4.4)	X (3007.7.4)	X (3007.6.4)	Minimum dimension of 8ft. 2015: Regardless of the number of FSAEs served by the same elevator lobby.	
FSAE Symbol	-	X (3007.7.5)	X (3007.6.5)		
Class I Standpipe Hose Connection	X (3007.5)	X (3007.10)	X (3007.9)	2009: Required in the "exit enclosure" having direct access from the FSAE lobby. 2012: Required in the "interior exit stairway and ramp" having direct access from the FSAE lobby. The exit enclosure containing the standpipe shall have access to the floor without passing through the FSAE lobby.	
Elevator System Monitoring	X (3007.6)	X (3007.8)	X (3007.7)	Monitored at the fire command center by a standard emergency service interface system meeting the requirements of NFPA 72.	
Electrical Power Supplied by Normal and Type	X (3007.7)	X (3007.9)	X (3007.8)	2009 & 2012: Features where this is required consist of elevator equipment, elevator hoistway lighting, elevator machine room	

60/Class 2/Level 1 standby power				ventilation and cooling equipment, and elevator controller equipment. 2015: Features where this is required consist of elevator equipment, elevator hoistway lighting, ventilation and cooling equipment for elevator machine rooms control rooms machine spaces and control spaces, and elevator car lighting.	
Protection of wiring or cables	**X (3007.7.1)**	**X (3007.9.1)**	**X (3007.8.1)**	2009: Wires or cables that interact with the elevator must be protected by construction having 1-hr minimum fire resistance rating or shall be circuit integrity cable having a minimum 1-hr fire resistance rating. 2012: Wires or cables that interact with the elevator must be protected by construction having 2-hr minimum fire resistance rating or shall be circuit integrity cable having a minimum 2-hr fire resistance rating.	

A more detailed discussion including the basis for the code changed follows:

2009 IBC - This edition of the IBC is where the FSAE is introduced and first required in buildings with an occupied floor more than 120 feet above the level of fire department vehicle access (403.6.1). The FSAE is required to have Phase I Emergency Recall Operation (3003.2), hoistway enclosure protection (3007.2), hoistway lighting (3007.3), a rated lobby enclosure (3007.4.2), rated lobby doorways (3007.4.3), lobby direct access to exit enclosure (3007.4.1), minimum lobby size of 150 square feet (3007.4.4), Class I standpipe hose connection (3007.5), elevator monitoring system (3007.6), electrical power supplied by normal and Type 60/Class 2/Level 1 standby power (3007.7), and 1 hour minimum protection of wiring or cables (3007.7.1).

Basis for Change - As a result of the Standards and Technology (NIST) investigation of the collapses of New York City's Word Trade Center towers on September 11, 2001 multiple changes were made to the ICC I-Codes. This is one of the needs identified from the study. The FSAE and the associated requirements of Section 3007 are intended to provide a reasonable degree of safety for fire fighters operation the FSAE to a location of staging firefighters and equipment. (BBRS) It has been documented that similar requirements for elevators are in the European codes, but the provisions adopted in the ICC codes do not replicate those requirements.

2012 IBC - All 2009 IBC requirements for the FSAE and lobby are also required in the 2012 IBC with some additions. The first addition is a requirement of a total of **two** FSAEs, or **all** elevators, whichever is less for buildings with an occupied floor more than 120 feet above the level of fire department vehicle access (403.6.1). For example, if you have designed your building to have only one elevator than that elevator must be a FSAE and an additional one is not required. This edition also requires all FSAEs to have a minimum capacity of 3,500 pounds (403.6.1). It is required that the building be equipped with an automatic sprinkler system, which shall have a sprinkler control valve supervisory switch and waterflow-initiating device provided for each floor that is monitored by the building fire alarm system (3007).

The locations prohibiting sprinklers consist of elevator machine rooms, elevator machine spaces, and elevator hoistways of FSAEs (3007.3.1). There also needs to be an approved way to prevent water from entering the hoistway enclosure from the automatic sprinkler system outside the enclosed FSAE lobby (3007.4).

Another requirement states that any means for elevator shut down in accordance with 3006.5 shall not be installed on FSAEs (3007.5). Structural integrity of hoistway enclosures also must comply with Sections 403.2.3.1 through 403.2.3.4 (3007.6). This means that the hoistway must match the structural integrity of interior exit stairways and elevator hoistway enclosures. The FSAE symbol was also introduced as a requirement in this edition (3007.7.5). The protection of the wiring and cables was increased from 1 hour to 2 hours in Section 3007.9.1.

Basis for Change - This is the specific requirement being challenged in the State of Florida. There were multiple code proposals submitted in the IBC process and proposals addressing number of FSAE's ranged from a minimum of three FSAE, to a requirement for two FASE with an exception that allows just one with an increased size. There was significant discussion about small footprint buildings and the impact of a second FSAE. **The result was a compromise that allowed only one FSAE if in fact the building was small enough (small footprint building) and only one elevator is provided. Two are only required, where in fact two elevators are provided in the building.** The final provision calling for two FSAE was added to the ICC and the need is based primarily on a survey conducted by the proponents, which includes the National Elevator Industry and the International Association of Fire Fighters. The survey resulted in 35 responses all indicating that the number of elevators used for firefighting operations varies from 2 to 6. Only one respondent, a suburban bedroom community indicated one elevator is sufficient for firefighting. Koffel Associates could not locate the documented results of this study. It is possible the proponents only documented the results in the code proposals.

The proponents also referred to past experience of fires in high-rise buildings that show elevators may not have been available due to maintenance or other reasons. Reliability was indicated as a concern and factor resulting in proposal for additional FSAE. It should be noted that there is a great deal of high-rise fire history available and some where the elevators were not in service at the time of the fire. However, there has been little work to associate the impact of that outage on the outcome of the fire.

2015 IBC - All 2012 IBC requirements for the FSAE and lobby are also required in the 2015 IBC with some changes. The most significant change requires FSAEs to be able to fit a 24 in. by 84 in. stretcher (403.6.1). This change increases the size of all FSAEs instead of just one as previously required.

Basis for Change - The justification is that firefighters use FSAEs to stage and to fight a fire, which means that these elevators will be occupied carrying firefighting equipment and personnel to the fire floor (G53-12). This means that if only one of the FSAEs is able to accommodate a stretcher than it may in use by the firefighters staging the fire and will therefore not be available to evacuate injured persons (G53-12). By having every FSAE large enough to hold a stretcher, you are theoretically able to evacuate disabled occupants regardless of which elevator the firefighters are using to stage the fire. A minor change to the code includes which locations are prohibited to have automatic sprinkler coverage. They consist of machine rooms, elevator machinery spaces, control rooms, control spaces, and elevator hoistways of FSAEs (3007.2).

Local Jurisdiction Impact

New York City and Chicago were two jurisdictions noted to have potentially excluded the requirement for two FSAE. Both cities have their own building codes. New York City's code is based on the ICC but the City has not yet adopted the 2012 Edition of the IBC. As such, the City has not weighed-in yet on whether they believe this requirement is cost effective and if they will adopt it.

The City of Chicago does not yet adopt the ICC family of codes and has their own Building Code. Currently they require only one FSAE and no documentation was found that indicates they have considered providing the second FSAE.

Additional Details on History behind FSAE

September 11, 2001 Tragedy - On September 11, 2001, there were sixteen minutes that passed after the first World Trade Center tower was hit and before the second tower was hit. During these minutes it was estimated that over 3,000 occupants were able to evacuate using the elevators (Lorenz). At this time in history, elevator evacuation during a fire was always advised against, and stair evacuation was seen as ideal even in high rise buildings. This event changed the way the US viewed elevators and emergency evacuation and made it apparent how critical elevators can be in an occupant evacuation. The NIST/GSA investigation/reports from the 911 tragedy resulted in numerous Code changes and changed the way the US saw the use and application of elevators during a fire or other emergency. Changes included adding provisions to "harden" elevators to increase reliability and allow elevators to play a more significant role in high rise buildings for both emergency evacuation and for fire fighter operations. As a result of this tragedy and the research from the tragedy, increasing elevator reliability and protection for fire fighter operations and occupant evacuation was introduced into the US Codes.

Elevator Reliability

One of the factors used as justification for the additional FSAE is elevator reliability and the need for the second elevator in case one of them is out of service. There was no statistical information found regarding how often elevators are out of service. There are however several reasons as to why an elevator would be down at any given time. Elevators are commonly down for maintenance, operation issues, repair, and modernization (Thornburg). If there is only one FSAE in the building, then there is an increased risk that the one elevator designed to protect the fire fighter could be the one out of service. Elevators in new construction are likely to be using state of the art technology which should make them more reliable and require less maintenance than elevators in the past. However, it needs to be recognized that even these new elevators will age and in time, maintenance will be required, increasing the likelihood that the FSAE will be out of service during an emergency.

The researchers received the following information from a representative of one of the leading elevator manufacturers[10]:

- A typical elevator for a high rise is out of service 2 to 4% of the time. Expect 4 to 6 short-term regular shutdowns a year (not due to external factors i.e. water damage, vandalism, etc).
- A typical repairs takes a few days, with major repairs taking two to six weeks, or longer with taller/older buildings. An elevator could be out of service for 6 months, depending on vintage, parts availability, obsolescence.
- Some customers have maintenance contracts that pay for expedited repairs.

A consultant to the elevator industry provided similar information on reliability.

- An elevator should be in service 99% of the time.
- There is a monthly preventive service that is usually about 1.5 to 2 hours.
- A ten-story elevator may have six to seven failures a year.
- Extended time of an outage is possible depending on the type of damage and age of equipment. It might take 3-4 hours, or a week or more, to repair an elevator. “For example, if the hoist cables need to be replaced due to an unexpected failure, this could take a week or more to obtain and replace the cables. Another example is if the elevator electrical equipment is damaged by a power surge or electrical storm, all of the electronic parts may require replacement, which could require a week or more.”[11]

Elevator Size

Under the 2015 IBC, the elevators have to be able to accommodate a 24-inch by 84-inch stretcher in the horizontal position. A typical 3500 lb. capacity elevator (2012 IBC requires all FSAEs to be of this capacity) is 80 inches wide and 65 inches deep. Assuming the code intent is to fit the stretcher in the horizontal position in the elevator, this size elevator is a little tight to fit the stretcher diagonally. In practice, the stretcher could fit by tilting slightly non-horizontal or if the stretcher allows the slightest of bending. An elevator of a few inches wider or longer could accommodate the stretcher without any problem. An elevator with an 80 inches by 65 inches interior has a 103 inches diagonal. An elevator with a 105 inches diagonal should fit the stretcher

[10] Mario Pereira, Otis Elevator Sales Representative, Miami Lakes, Fl.

[11] Email communication with Robert (Bob) Dieter, Vertical Transportation Consultants, Apalachicola, FL

horizontally. An extra factor of safety should be incorporated. Elevator manufacturers indicate their standard 3500 lb. capacity elevators can accommodate the required dimensions in single-door models (which allow slightly more room by the thinner door) while acknowledging double door models are usually preferred by customers.[12]

Lease Costs

To help determine some of the economic impact, the research team examined potential loss of revenue from reduced space for those projects that might need to add additional room for a lobby. According to LoopNet.com, which claims the most comprehensive resource for commercial real estate online with over 800,000 listings, the average asking rental rate per sq ft/year for office properties Florida was $17.28 as of Feb 16. The value varied by location. For instance the average office rent for February 2016 was given in Daytona Beach as $15.46, Jacksonville $15.60, Orlando $20.13, Miami $27.34, Tallahassee $17.49, and $19.56 for Tampa.[13]

Assemble an Access Elevator Industry Advisory Group

The purpose of the industry advisory group is to provide expert input and advice during the development of the survey tool to be used to collect cost and other relevant data regarding the inclusion of a second fire service access elevator into high-rise buildings.

The first step was to identify various stakeholder groups who would be affected by the requirement for a second fire service access elevator. The following list was developed:

- Developers
- Architects
- Engineers
- General Contractors
- Cost Estimators
- Fire Marshals

It was anticipated to have each of these groups represented by at least one member of the industry advisory group. Online research was conducted to identify various companies and individuals from each group who had experience with high-rise construction. This research consisted of reviewing state and national databases, newspaper and magazine articles, as well as personal references. Based on advice from legal counsel no one currently serving on the FBC or TACs was requested to serve.

A telephone and email outreach process was used to contact and invite these individuals to volunteer to be a part of the industry advisory group. The following individuals agreed and the industry advisory group consisted of:

[12] Rob Vieira private communication with representatives from Kone and Otis Elevator companies while at the 2015 USGBC conference in Washington, DC.
[13] http://www.loopnet.com/Miami_Florida_Market-Trends as presented on April 29. 2016. Other cities available by selecting Florida again from the state location.

- Sheldon Powell, Gables Development - Boca Raton, FL
- Ralph Hippard, Cost Estimator - Tallahassee, FL
- Bruce Faust, Fire Marshal, Orange County, FL
- Stu Cohen, Architect, Cohen, Freedman, Encinosa & Associates - Miami, FL
- Les O'Bryan, Vice President, Coastal Construction Group – Miami, FL

Additional team members who participated with the industry advisory group included:

- Rob Vieira, Director, Buildings Research Division, FSEC, UCF - Cocoa, Fl
- Michael Houston, Architect and Builder - Orlando, FL
- Vernet Lasrado, Ph D, Assistant Director, Office of Research & Commercialization, UCF - Orlando, FL
- Sharon Gilyeat, PE, Principal, Koffel Associates - Columbia, MD
- Lauren Schrumpf, Fire Protection Engineer, Koffel Associates - Columbia, MD

A teleconference was held on Thursday, October 22, 2015 with all industry group representatives present. The announcement and agenda for the meeting are presented in Appendix H.

A presentation of the project history as well as background on the code changes was provided. And a summary of the preliminary research provided by Koffel Associates regarding fire service access elevator requirements was reviewed.

A robust discussion was held about the addition of a second fire service access elevator and its impacts on the design of high-rise buildings as well as the cost of construction and lost leasable square footage.

These impacts can be summarized as follows:

- In high-rise buildings with multiple passenger elevators a second elevator needs to be equipped to serve as a fire service access elevator.
- If the elevators are remote to each other the second elevator lobby needs to be fire and smoke protected.
- Some high-rise buildings have only one passenger elevator (which is also a fire service access elevator) and one service elevator each with their own lobbies. The design options are to add a second passenger elevator (which is also a fire service access elevator) using the same lobby or to convert the service elevator and lobby into a fire service access elevator and lobby.
- A fire service access elevator requires a larger footprint, additional electrical and communications requirements, additional waterproofing requirements, and additional fire and smoke barriers around the lobby.
- All of the above involves additional construction costs to some degree and results in a loss of leasable square footage – albeit minor in some instances.

The initial draft survey was reviewed and revisions and additions suggested as a result of the above impacts.

The group then discussed the options for distributing the survey to stakeholder groups and several suggestions were provided.

Additional contact information was provided for several elevator equipment manufacturers and installers as well as for fire protection engineers. These individuals were later contacted and asked to provide additional input regarding the draft survey.

Once a revised draft survey was produced, the industry advisory group reviewed it and in some cases completed the survey to illustrate the types of answers that might be received.

A final survey was then produced based on the input from the industry advisory group.

Access Elevator Survey Instrument:

The survey was drafted by FSEC and reviewed by the other project team members (Mike Houston, Koffel and Associates, Vernet Lasrado). After editing, the survey was reviewed by the industry advisory group. The advisory group made suggestions. One of the suggestions led to added questions regarding building designs where they felt an additional lobby space may be needed which would significantly drive up costs. Thus the elevator survey contains two examples, one a three elevator passenger high rise building (no extra lobby required) and one a building with one passenger high rise and one service elevator as is sometimes found in some residential towers that have limited units on each floor. The survey went through more edits and project team reviews before being entered into the UCF Qualtrics software for conducting surveys (see Appendix I for survey instrument).

Access Elevator Survey Distribution:

The survey was sent to 42,000 architects, general contractors, engineers as provided by DBPR. Thousands of those were returned as undelivered. It is unknown how many ended up in people’s spam. Seventy-two were returned with a request for identification before receiving email. Those requests were completed in an effort that the recipient may see the survey. The survey was also sent to 267 registered elevator company representatives, and 23 cost estimators represented as conducting cost estimation in the eastern U.S. It was also sent by DBPR to 5000 people on their code mailing list. A reminder email was sent to all recipients (from FSEC) on November 16 warning about the November 20 deadline. It is estimated that only a small percentage of all these recipients actually are the stakeholders who work on high rise buildings. It is similar to sending a survey to everyone working in agriculture in Florida but you only ask those growing guavas to respond.

Research was conducted that led to a small group of names of leading high rise developers and architect firms (some are headquartered out of Florida but had completed high rise structures in Florida). Calls were placed but usually those did not result in a conversation with the key people or receiving email addresses. Instead, a postcard was sent on November 6 to 19 developers and 23 architect firms.

Access Elevator Survey Responses:

We received 342 surveys that had at least answered one question. Appendix J provides a summary report of responses. Although 342 respondents is an incredibly small return rate based on the mass mailing, to have 342 people volunteer their time to return a survey on an elevator code issues seems like a good number of participants for which to draw conclusions. The number of Florida professionals working on high rise structures is unknown so it is difficult to assess the statistical significance of the return.

Identified Professionals and Experience

Figure 33 shows a breakdown of the respondents by profession (Appendix K provides cross tabulations by profession):

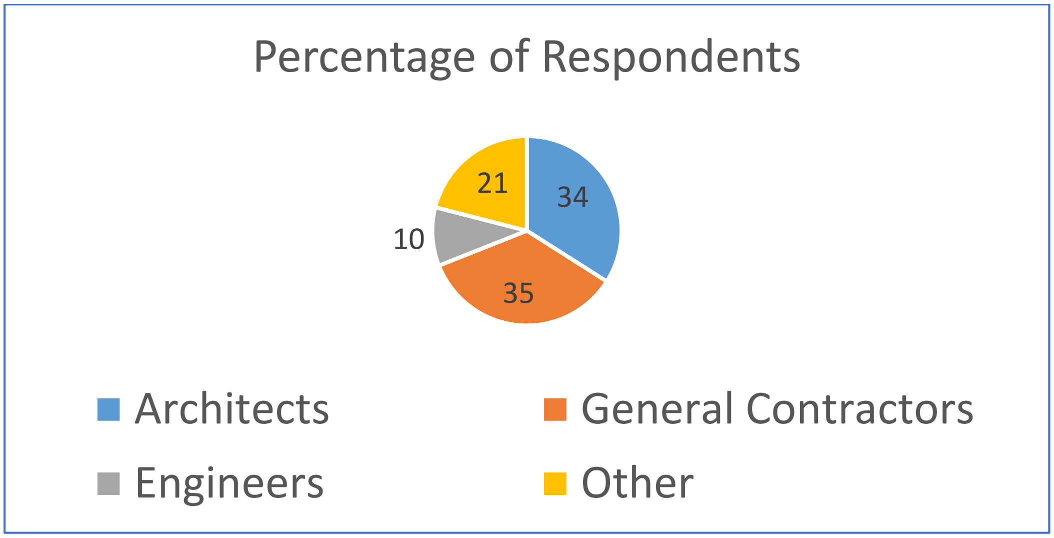


Figure 33. A breakdown of 342 survey respondents by profession –more detail is available in the appendix

The survey asked the counties the person typically serves. There were 26 respondents who said all of Florida. A few indicated a region, while most listed counties. Table 16 on the top of the next page shows all the counties listed by ten or more people. Although northwest Florida coastal counties are not on this list, each had 4 to 8 respondents listing those as served counties. Thus, the respondents were representing the state reasonably well.

When asked “Approximately, how may high-rise projects (ten stories or higher) have you been paid to work/consult on?” 226 respondents indicated 1 or more projects. Those who worked on five or more were 148.

One hundred and twenty seven (127) respondents answered *yes* to “Have you ever helped design, build or specify a fire service access elevator for a building?” Another 133 indicated *no*. Those without experience were directed to non-cost questions. Those answering *yes* were asked “approximately how many fire service access elevators have you designed/constructed?” The median of the 106 non-zero respondents was 5. This included five respondents with 100 or more buildings and a total of thirty with 10 or more (see histogram in Figure 34).

Table 16. Counties Served by Respondents.

County	Number of People Listing the County as an Area They Serve*
All of Florida	26
Brevard	18
Broward	73
Charlotte	10
Collier	18
Duval	17
Hillsborough	27
Indian River	10
Lee	17
Manatee	13
Martin	13
Miami-Dade	91
Monroe	11
Orange	41
Osceola	10
Palm Beach	47
Pinellas	23
Polk	11
Sarasota	23
Seminole	17
St. Lucie	13
Volusia	15

* Each person could write in the counties they served. In addition to the 26 indicating all counties, there were 7 who simply listed regions, e.g, North Florida. For brevity, this table only shows counties specified by ten or more respondents.

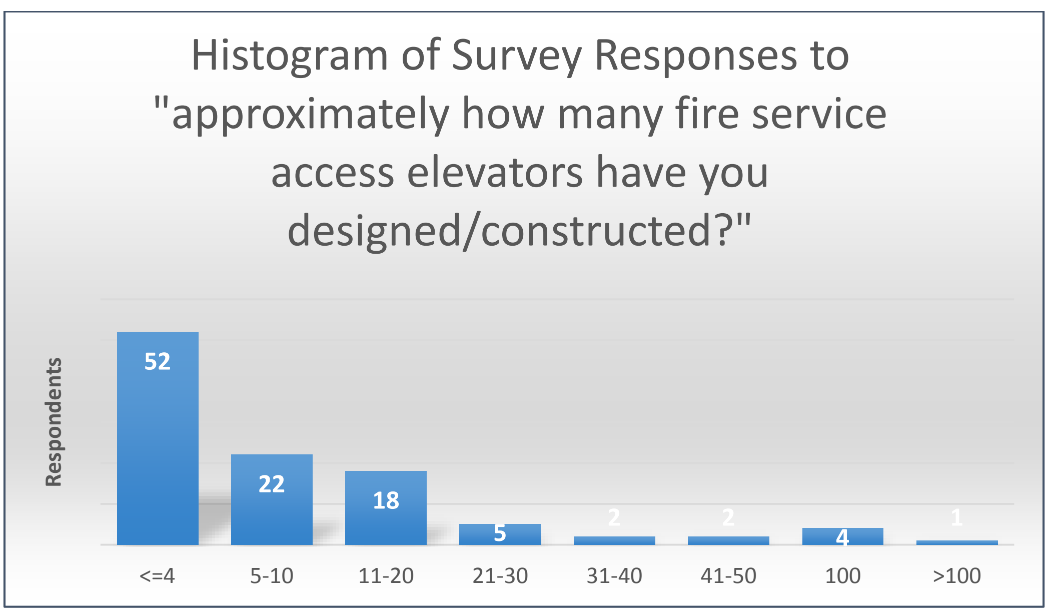


Figure 34 Quantity of fire service access elevators designed/constructed.

Thirty six (36) out of 117 respondents (31%) indicated they worked on projects that had more than one fire service access elevator. The follow–up question was "If yes, why were they equipped with more than one fire service access elevator?" Thirty-five responded; many indicated it was code for where the project was located such as locations following 2012 IBC and redundancy. Each comment is included in the appendix.

Sample project 1 costs

The 127 respondents who had indicated some experience were asked to estimate costs for an example building. The example given was, "Please provide an estimate of additional cost for a new project for which planning is just beginning. The project calls for three elevators for a 12-story office tower with interior lobbies and corridors. Under Florida 2010 code, one elevator would be required to be a fire-service access elevator and the other two could be non-fire-service-access elevators. Under the 2014 Florida code language (the part delayed by the legislature), there would need to be 2 fire service-access elevators for this project."

The responses were to this question, "For this project then, what is your best estimate of the additional cost ($) for making a second elevator fire-service access compliant (assume it is being served by the same lobby as the other fire service access elevator)?

The median response from the 25 respondents with 5 or more FSAE job experience was $82,000, compared to $100,000 for the 52 respondents with one or more FSAE experience. The range was large as ten percent of those 52 respondents thought it would cost $12,000 or less, while 10 % thought it would cost $500,000 or more. This data is shown graphically in Figure 35 below.

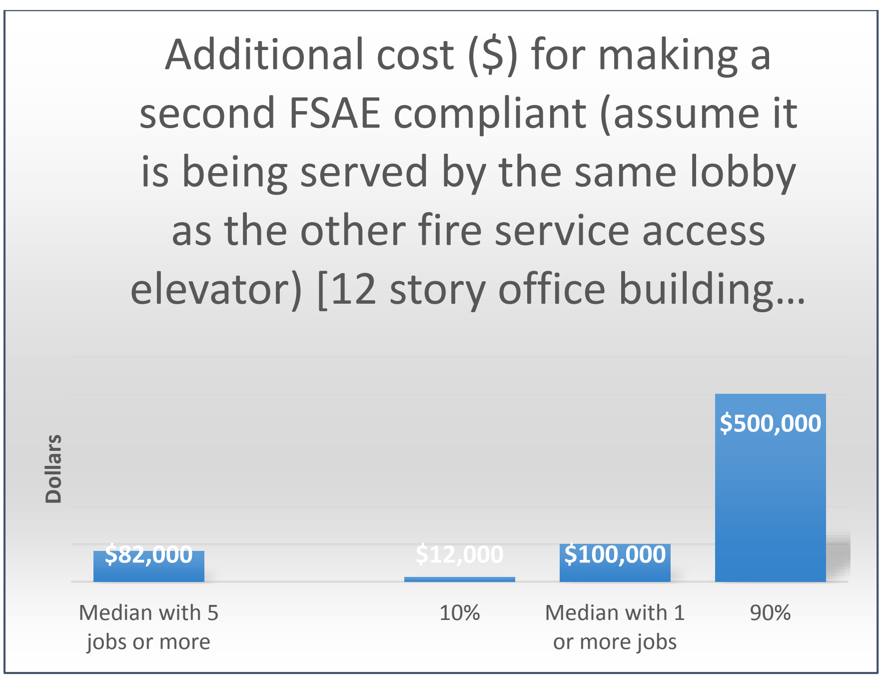


Figure 35. Survey Responses to Costs for Making a Second elevator FSAE compliant

Respondents were asked to comment on their estimate and many did. All comments for all questions and simple tabulations of results are included in the appendix. Nineteen respondents indicated that the hoistway, machine room, controls and emergency power would be the primary cost items, including such as this response “Increases elevator controls cost, size and cost of emergency generator, communications equipment in the elevator.” Ten discussed the cost required for increased area such as these responses: “The extra fire access elevator itself is not the issue, it’s the required stair for the fire elevator access lobby,” and “Larger elevator, enclosure with access to a fire stair, fire communication, and additional fire riser. That's a lot for a 120' building.” This despite that the example was for the second FSAE served from the same lobby areas as the first FSAE. Six others provided the basis of cost estimates, often per floor “Assume additional $8,000 per stop to one of the already specified elevators.”

A follow-on question also asked if there were factors that would increase or decrease their estimate. Only 35 people responded to that question with 33 responses that factors would increase the cost they had presented and 15 responses (they could select both answers) indicating factors could decrease the cost. Fifteen people commented their cost estimate would increase for taller or more spread out buildings. Two people commented on the potential need for increased sprinkler or alarm systems and five commented on the increased generator capacity needs. Labor and material variation was a reason for price increases or decreases. Someof the responses to the comment and the factors included lobby concerns, many of those concerns were addressed in the sample project 2 survey question.

Sample project 2 costs

The second project was designed to learn about added lobby costs when those would occur for a second fire service elevator. “What if there was another 12-story project being planned with one passenger elevator (a fire service access elevator) and one service/maintenance elevator serving a different lobby. What would be your estimate of the additional costs to convert the service elevator lobby into a fire service access elevator lobby?” The median of the 22 respondents with five or more jobs was $100,000. The median of the 49 respondents with 1 or more jobs of experience was $85,009, with 10% of those indicating it would cost $20,000 or less and 10% indicating it would cost $350,000 or more as shown in Figure 36.

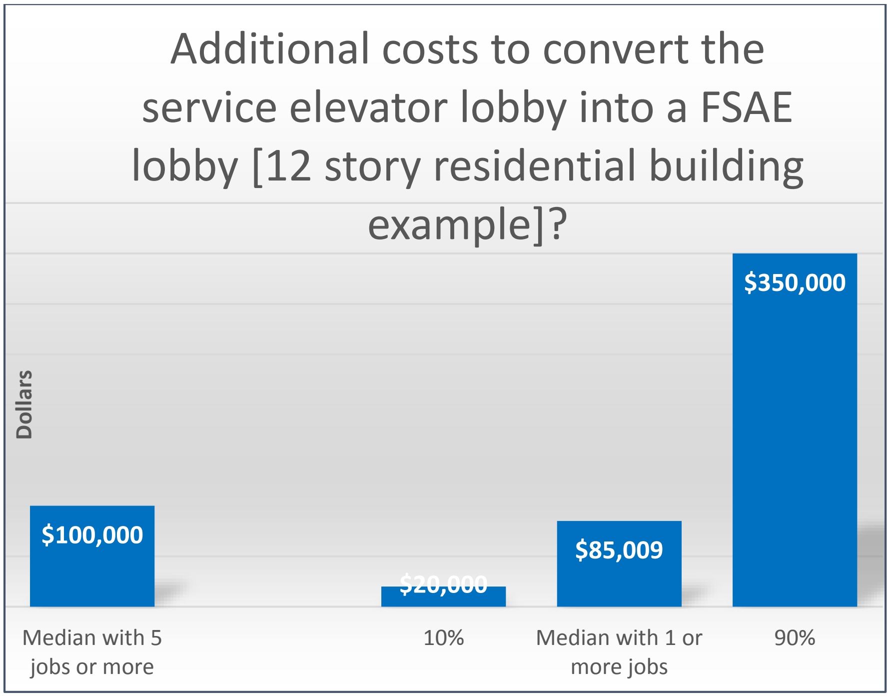


Figure 36. FiveSurvey Responses to Costs for converting a service elevator lobby into a FSAE lobby

Comments were requested and received from 48 survey takers about the cost estimates. Six respondents described the area costs while 17 mentioned equipment costs. Eight people specifically mentioned the cost of fire prevention for the lobby areas such as this one, “Fire-rated wall and door construction to separate the proposed elevator lobby from the adjacent space(s),” and this one “Many factors are involved including the fire rating of all interior finishes currently within the building, coverage of sprinkler heads, length of pathway, exterior access for first responders.” Five people indicated it would be a similar cost to the first example.

A follow-on question was asked “Are there any other design situations where the two fire service access elevators would be separated and would therefore require a second fire service access elevator lobby?” Of the 42 responses, twelve listed building geometry or height as a reason, such as this response, “The footprint of the building - if it was spread out and had two clearly different vertical transportation cores.” Client specific reasons were given by 6 people, including this response, “Hospital or medical facilities. Perhaps prison or penitentiary facilities and perhaps high occupancy areas such as auditoriums and theaters.” Eleven others said that there likely were situations and three indicated they could not think of other situations which would require a second lobby. Two people mentioned distinct entrances/exits as a reason including this detailed response, “ONLY if there are 2 VERY DISTINCT entrances to a building. / Most people will return to the entry from which they entered during a fire. If the building is long/convoluted/has 2 towers that are characteristically differentiated such that people perceived they entered from a specific point, then that would be valid consideration. / / I'm "on the fence" if there should be 2 because the interior corridors are long/convoluted but there is only 1 perceived entry point. Possibly the fire fighters would have more control or remote access while the majority of the people ran to the "entry" elevator.”

Survey takers were then asked to estimate how often a second FSAE lobby would be needed in jobs they do. “If the code already required two fire access elevators at the time a project begins, how often would a second lobby for a fire service access elevator be required for your typical projects (estimated % of projects requiring an additional fire service access lobby)?

Out of the 56 respondents, the mean average was 22.7%. Note, the mean is used for this answer as opposed to the median used for costs as there is an upper and lower limit for percentile so skewing due to an extreme answer was not a concern. Zeros and 100% were acceptable answers for this question and included in the average.

Most recent job

The survey instrument also tried to assess costs of the respondents’ most recent job, along with information about that most recent job. This was handled through a number of questions as to understand the projects. The cost question was for all fire service access elevators as it was anticipated that with the second fire service access elevator not being code in Florida, few respondents might have worked in buildings with more than one. Thus the costs per FSAE might be larger than for projects where a second designed elevator is built to be a fire service access elevator.

The cost question consisted of “What was the approximate additional construction cost ($) to make the elevator(s) fire service access compliant? Include all associated construction costs.” The median of the 17 respondents with 5 or more FSAE experience was $100,000. The median rose to $112,000 if the 37 respondents who had 1 or more FSAE experience were included. The range varied significantly as the number of stories and elevators differed as well.
Ten percent of the 37 respondents thought it cost $15,000 or less and another ten percent though it cost $675,000 or more (see Figure 37). In order to better understand the most recent job cost data a number of questions were asked:

- What was the approximate total building project cost ($)?
- How many stories was the structure?
- How many fire service access elevators were installed?
- How many total elevators were installed?
- How many fire service access elevator (elevators) were in the original design for this structure?
- What type of corridors were provided?
  ☐ interior
  ☐ exterior
  ☐ both
- What type of expected use was the building?
  ☐ Residential
  ☐ Retail/Office
  ☐ Mixed: Residential and Retail/Office
  ☐ Other ___________________

- What was your role on this project?
  ☐ Architect
  ☐ Civil/Structural Engineer
  ☐ Cost Estimator
  ☐ Developer
  ☐ Elevator Manufacturer/Installer
  ☐ Fire Protection Engineer
  ☐ General Contractor
  ☐ Local Fire Emergency Professional
  ☐ Mechanical/Electrical Engineer
  ☐ Other: ____________________
- What is the status of this project?
  ☐ In design/finance phase
  ☐ Permitted but construction has not begun
  ☐ In construction
  ☐ Occupied

Key details provided about the buildings from the respondents are shown in Table 17 One data point was for a building with 60 stories whereas all others were for buildings with 50 stories or less. *Other* as a building type response was completed by 11 respondents with 4 listing "Hotel" and the other seven had unique answers (See Appendix L).

The median ratio of the total fire service access elevator costs to the total project costs was 0.0032 or 0.32%.

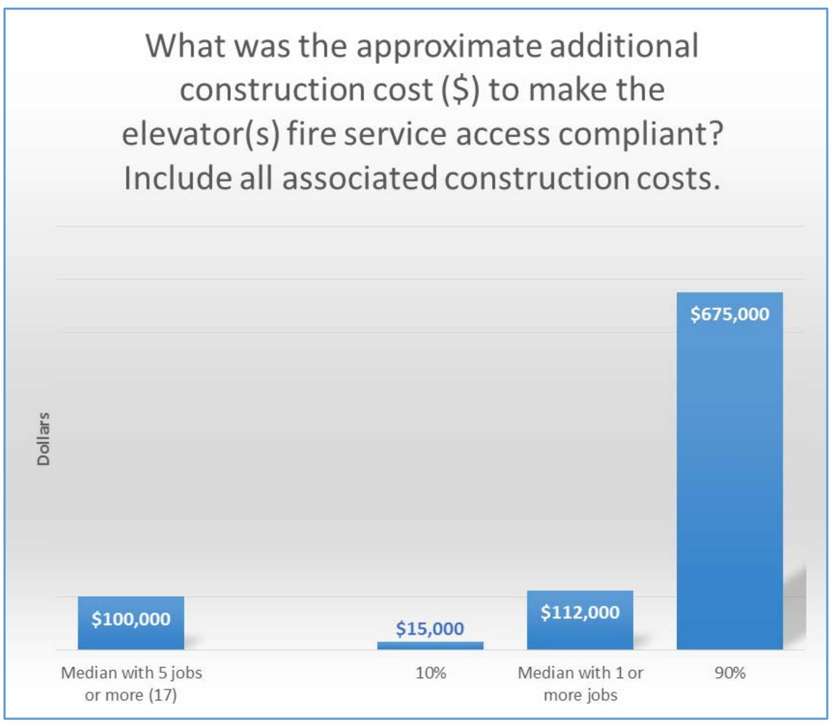


Figure 37 Additional construction cost to make the elevator(s) fire service access compliant.

Table 17. Responses to Costs and Building Characteristics of Most Recent Job with a Fire Service Access Elevator

FSAE Compliance Cost (Q15)	Total Project Cost (Q16)	No. of Stories (Q17)	No. of FSAE Installed (Q18)	No. of Elevators Installed (Q19)	Expected Use (Q22)	FSAE to Total Project Cost Ratio
0		15	1	15	Retail Mixed Use/Hotel	
0		42	2	2		
0	17,500,000	45	2	6		-
0	130,000,000	30	1	4		-
0	250,000,000	50	1			-
0	280,000,000	20	1	10	Institutional / Business	-
4,200		20	2	7		
8,000	2,000,000	17	2	6		0.0040
12,000	13,500,000	14	1	3		0.0009
15,000	10,000,000	10	2	4		0.0015
25,000	65,000,000	6	1	7	Government	0.0004
28,000	22,478,500	8	1	1		0.0012
30,000	650,000,000	19	2	25		0.0000
40,000		8	1	3	Self Storage	
40,000	80,000,000	24	12	12		0.0005
40,000	90,000,000	46	2	10		0.0004
43,000	63,000,000	25	1	6		0.0007
50,000	10,000,000	8	1	4	Medical	0.0050
50,000	40,000,000	15	1	4		0.0013
50,000	60,000,000	23	2	4		0.0008
59,000	9,000,000	18	1	2		0.0066
65,000	32,985,000	19	1	4		0.0020
80,000	24,000,000	30	2	4		0.0033
100,000	15,000,000	40	2	8	Hotel	0.0067
100,000	60,000,000	26	5	10		0.0017
112,000	77,315,000	14	1	6		0.0014
125,000	50,000,000	15	1	5		0.0025
150,000	55,000,000	15	1	6		0.0027
150,000	75,000,000	25	1	3		0.0020
150,000	96,000,000	10	1	4	Institutional	0.0016
190,000	55,000,000	24	1	6	Hotel	0.0035
200,000	20,000,000	12	1	4		0.0100
200,000	72,000,000	25	2	4		0.0028
250,000	50,000,000	18	1	3		0.0050
265,000	36,000,000	19	1	6		0.0074
300,000	96,000,000	30	2	5		0.0031

320,000	60,000,000	16	2	2		0.0053
350,000	45,000,000	12	1	3		0.0078
400,000	90,000,000	24	1	4		0.0044
456,000	12,000,000	15	2	5	Hotel	0.0380
650,000	65,000,000	42	2	7	Hotel	0.0100
675,000	55,000,000	20	2	5		0.0123
700,000	120,000,000	30	2	21		0.0058
1,000,000	200,000,000	60	2	20		0.0050
2,000,000	100,000,000	36	1	4		0.0200
*210,716**	***81,799,476***	***23***	***2***	***6***	***Mean****	***0.0046***
*80,000**	***60,000,000***	***20***	***1***	***5***	***Median****	***0.0027***
*0**	***2,000,000***	***6***	***1***	***1***	***Minimum****	***-***
*2,000,000**	***650,000,000***	***60***	***12***	***25***	***Maximum****	***0.0380***

**** Qualified Question 15 Results Shown in Figure XX***

Responses above are to questions asked as survey Part IV - Most Recent Experience

Q15 - What was the approximate additional construction cost ($) to make the elevator(s) fire service access compliant? Include all associated construction costs.

Q16 - What was the approximate total building project cost?

Q17 - How many stories was the structure?

Q18 - How many fire service access elevators were installed?

Q19 - How many total elevators were installed?

Q22 - What type of expected use was the building?

Overall factors impacting cost

The survey included a multiple choice question asking “Based on your experience, what factors have a significant impact on the additional cost of making a second elevator a fire service access elevator assuming it was planned from the design stage (check all that apply)?” Figure 38 shows the response tally. *Incorporating the emergency generator requirements* was the most popular answer.

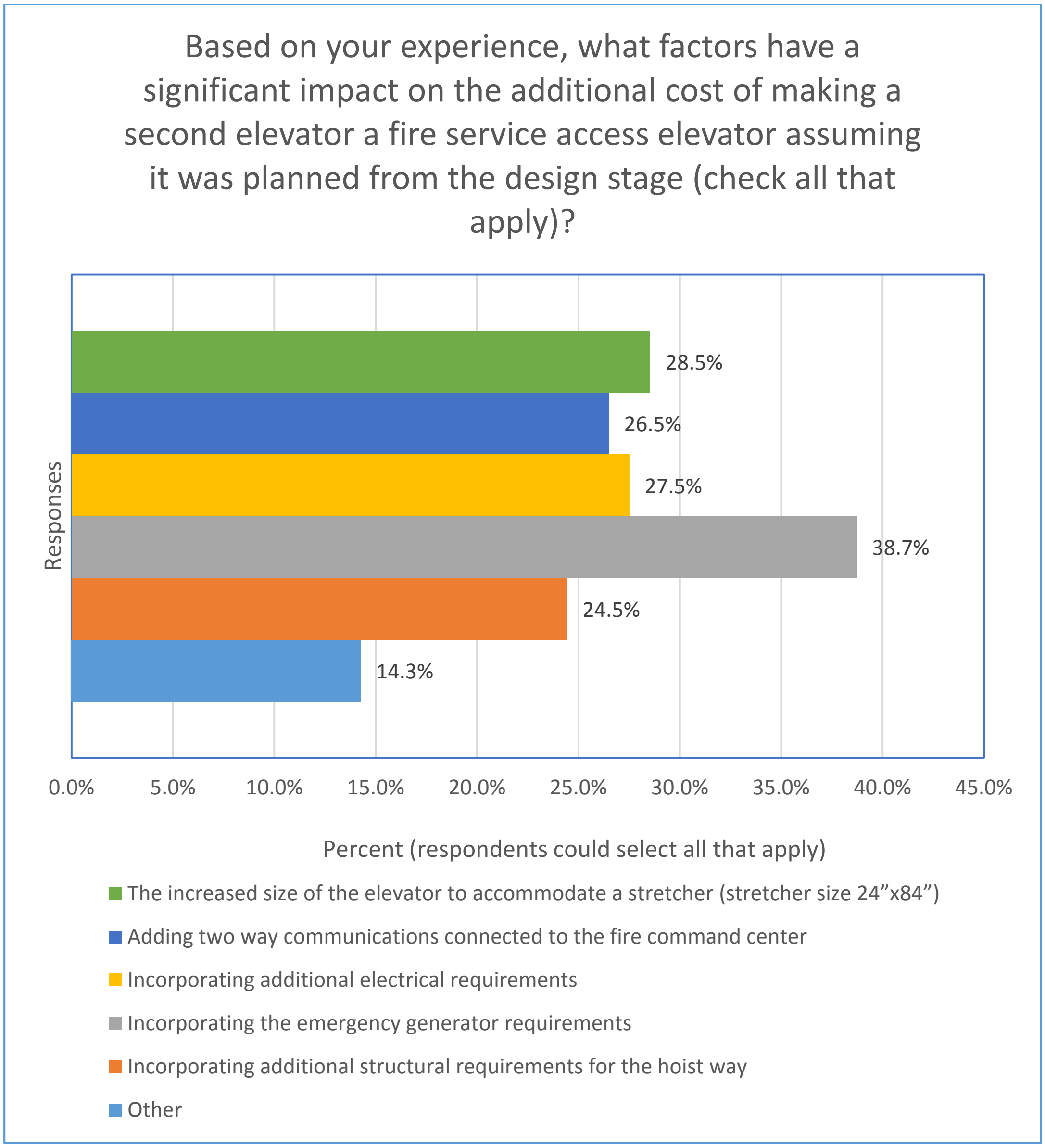


Figure 38 Reponses on features that have the most impact on FSAE cost

Of those indicating *Other*, this is what they indicated:

- The extra stair to service the fire elevator access lobby
- Lost useable and rentable space
- Additional space for fire fighter lobby
- Fire proofing
- Additional air conditioning requirements, loss of rentable space
- I would not require full stretcher access but rather reclining chairs
- Independence of multiple elevators is unclear and inpretative, if permitted within same shaft, lobby and load shedding, no significant impact. If independent lobbies, shafts, stairways AHJ required then costs and design impact are significant.
- Additional Fire Service Elevators due to multiple private elevator cores.

- Biggest factor is locating fire service access lobby directly connected to egress stair. 2 elevators could have programmatic issues.
- lost lease area
- Elevator maintenance contracts, after hours service calls
- All of the above
- air plenum costs
- Increased building area for the fire service elevator lobby. Position of the lobby in the building and potential to need to add a third exit stair.

Overall benefit

The last tabulated question asked to all respondents (including those that had skipped all of the cost questions due to no experience) was "Do you anticipate the Code's 2nd fire service access elevator will be beneficial overall?" The responses are shown in Figure 39.

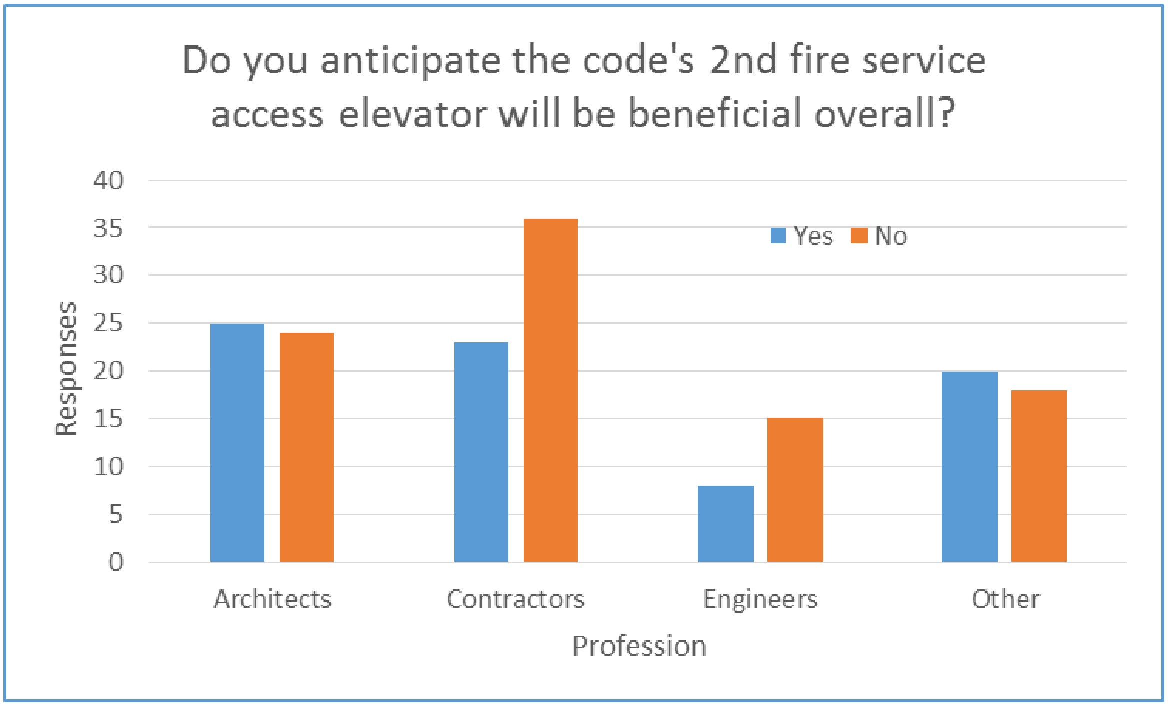


Figure 39 Response to survey question on overall benefit of second fire service access elevator

Comments

In order to obtain as much information as possible from survey participants, two questions were directed at open end comments.

"Do you have any specific concerns about the requirement?" and "Additional Comments?"

The specific comments are included in Appendix L. Twenty-six people voiced concerns about the cost. Nine commented such a requirement is not needed while five wrote the safety benefit was worth it and another five wrote that two would be better than one. Ten indicated that the 120 foot requirement should not be the threshold but rather by square footage and stories, occupancy or a higher number of stories. Others had answers difficult to categorize or simply indicated they had no other comments. The following provide a sampling of some of the more detailed comments received:

- "Always adding to what is wanted with vast increase in cost and limited improvement or limited safety help. Focus should be on 'reasonable' and safety and usefulness
- "The cost of the code change should be weighed with respect to the need of a second" elevator. In aviation, which has a solid safety record, the ad's or modifications to aircraft are only required after a study of cost and effect on existing planes. Has there been such a study? I would guess that the effect would be great on large cities and in some cases impossible to comply with."
- "Don't elevators shut down during a fire? Why do we need a second elevator? You guys are going to increase the price of construction so much, investors are going to go to Georgia."
- "For an isolated incident, the cost seems to be excessive. If the only requirements were a separate shaft and separate equipment, and power to run off emergency generator, that would be one thing, but a host of additional special requirements makes the additional costs excessive."
- "The assumption that first responders will use a full stretcher is incorrect. Most stretchers will not go around corners and so a reclining wheel chair, which requires a shorter elevator length is a better solution if a second elevator is mandated. The use of a reclining chair would cut the elevator cost by at least 25% additional cost."
- "It has fundamentally changed how high-rise buildings are designed. There is obviously more cost, but it is a very difficult matter to quantify. Old Code we designed "oranges", New Code we design "apples". They are not the same. If the State of Florida makes a determination that only one fireman's elevator is required, do you still connect it to one fire stair? Do you still recognize the increase in the dead-end distance? Are the two fireman's elevators and connection to the fire exit stair fundamentally safer than a shorter deadend, apparently the IBC has determined so. If Florida allows one fireman elevator, are they taking on the position that they disagree with the IBC?"
- "Most ten story and higher structures that we have worked are designed with more than one isolated elevator shaft providing a viable fire service access elevator in the event of an emergency. Although the price to provide a second fire service access elevator on some smaller buildings would be prohibitive, I feel that the over-all safety of the building occupants should be the over-riding criteria in the development of new codes."
- "A second fire-service elevator would be obviously beneficial if the first were inoperable due to a fire. However, the instances of its necessity are extremely rare in 10-20 story buildings. The requirement adds significant cost to a relatively small building of Type I construction that has a very good life safety history. I think the requirement would be more in line with taller buildings (20+ stories) where risk may be greater."
- "The statistical probability there is an event warranting two fire access elevators is what? Given we can qualify (count) the building in the state to date that are over 120' and we can access the fire department's history per location. It should be an easy calculation. Given my personal experience in 30 years, I never seen it. Short of an airplane impact which is once every five years in the nation, what possible situation would require more

than 12 fire fighters at once (arriving on the effective floors). Given the fact that fire fighters don't arrive in groups of 8 or more at once because of the fire station requirements."

- "Adding additional cost for an event that might never happen in the life cycle of a building for another fire elevator is overkill for a building that low. With type I construction, fire sprinkler systems, egress stairs in fire rated shafts, exhaust systems, standpipe systems, the occupants should have enough time and protection to evacuate a building."
- "A "one size fits all" approach seems inappropriate. Perhaps the requirement should be applicable only after some minimum building footprint or configuration is exceeded."

Additional comments were completed by 26 people, although one simply wrote 'None.' Four of these were along the lines of saying the second FSAE is not beneficial, such as this response, "There has been an extreme concern about the safety of high rise buildings for many years. Back to the Paul Newman disaster movie the Towering Inferno, but the facts indicate that current high rise structures equipped with fire sprinklers, emergency generators and modern fire detection system are among the safest structures we build. Far more people die each year from house and apartment fires. If we are truly promoting safety rather than worrying about potential future headlines we should concentrate our efforts where the risk is."

The following response was one of five received that expressed concerns of the cost trade-off, "Over and above adding significant dollars to cost of the construction of a Tower, the guidelines and requirements of the second elevator has made the design of residential towers less efficient, and leaving cumbersome amounts of inefficient space. / I endorse appropriate safety regulations for those living in a residential tower.as saving lives is more important that saving construction costs. But I am not sure that some of these new "safety" building codes are initiated because of an unusual circumstance, rather than from reasonable practicality."

Access Elevator Code recommendations:

The research team concluded that no specific code recommendation could be derived from the research. The concerns about the stretcher size were addressed in the Florida supplement for the 2017 code. The 2016 legislature extended the delay so many of the concerns brought up to the Florida Building commission in 2015 regarding the inability to alter projects already in the design stream but not yet permitted should be handled. The survey responses were mixed regarding benefits. And due to the code change being recent, there are not fire case results to indicate life/safety benefits. Overall the increased cost due to the second FSAE was estimated as a small fraction of project cost.

The 2016 Florida legislature passed code changes regarding the second fire service access elevator in House Bill 535 that largely addressed the lobby:

The Florida Building Code shall require two fire service access elevators in all buildings with a height greater than 120 feet measured from the elevation of street-level access to the level of the highest occupiable floor. All remaining elevators, if any, shall be provided with Phase I and II emergency operations. Where a fire service access elevator is required, a 1-hour fire-rated fire *service access elevator lobby with direct access from the fire service access elevator is not required if the fire service access elevator opens into an exit access corridor that is no less than 6 feet wide for its entire length and is at least 150 square feet with the exception of door openings, and has a minimum 1-hour fire rating with three- quarter hour fire and smoke rated openings; and during a fire event the fire service access elevator is pressurized and floor- to-floor smoke control is provided. However, where transient residential occupancies occur at floor levels more than 420 feet above the level of fire service access, a 1-hour fire-rated service access elevator lobby with direct access from the fire service access elevator is required. Standpipes in high-rise buildings of Florida Building Code—Building Occupancy Group R1 or R2 must be located in stairwells and are subject only to the requirements of the Florida Fire Prevention Code and NFPA 14, Standard for the Installation of Standpipes and Hose Systems, adopted by the State Fire Marshal.*[14]

Task 4: Industry Presentations:

Presentations of the results to industry groups were provided as indicated in Table 18. Five presentations to groups about the residential survey were made. Four of these were local Florida groups and one was a national gathering of experts. The DOE expert meeting was held at FSEC following the ASHRAE national conference in Orlando. Representatives from the leading mechanical ventilation companies as well as the leading researchers from national labs and universities were in attendance. The residential presentations given included results from this study as well as the ventilation reliability study completed in 2015 (Sonne, et al. 2015) which examined existing whole house mechanical ventilation systems in 21 Florida homes. That study included the recommendation to raise the residential ACH50 limit from 5 ACH50 to 7 ACH50. It also included the recommendation to reduce pressure differences form kitchen exhaust hoods of 400 cfm or more. The elevator results were presented in a recorded webinar March 29. Some people could not make the webinar so a second was held for those stakeholders on May 5. The first webinar is available for viewing online at https://vimeo.com/160784001. The elevator results were also presented to a local group of fire professionals in Sanford on April 13. Table 18 includes comments received from each presentation.

Table 18. Presentation of Results to Industry Groups

Date	Group (and approximate attendance)	Location and Presenter	Topic	Key comments received
Dec. 10, 2015	Brevard HBA (10)	Melbourne Rob Vieira	Failure rates and cost of residential whole house mechanical ventilation systems (Residential Blower Door and Ventilation Survey Results and Ventilation Evaluation Study)	Keep the code changes simple; If a builder has to test their home to 5 ACH50 he will build it to 3 ACH50 to make sure he doesn't have to make any last minute changes.

[14] Florida House of Representatives, CS/CS/CS/HB 535, 2016.

Jan. 28, 2016	**Expert Meeting on Smart Ventilation (25)**	**Cocoa Rob Vieira**	***Failure rates and cost of residential whole house mechanical ventilation systems***	***Manufacturers heard about Floridian's concerns and acknowledged issues, some are working on solutions for reliability***
Mar. 10, 2016	Refrigeration & Air Conditioning Contractors Association (RACCA) (17)	Tampa Jeff Sonne	Mechanical Ventilation Costs and Failure Rates in Florida Homes	Don't want code to tell us when mechanical ventilation is required; Test and balance and it will take care of itself (slight negative pressure will bring in the outside air / but need to test and balance to make this happen); Due to occupant behavior differences, "one for all" type requirements won't work well; Homeowners will just turn the mechanical ventilation systems off; This is one of the most misunderstood and most costly aspect of our trade and interpretations of enforcement as well as status is widely conflicting. The 7 ACH change would help ease the apprehension of the blower door requirements.
March 29, 2016	Webinar (95 signed up, 42 attended)	Mike Houston Rob Vieira	The Economic Impact of Building Code Change Requiring a 2nd Fire Access Elevator in Florida High Rise Structures	See Appendix M for question and answer transcript.
Apr. 7, 2016	Manasota Air Conditioning Contractors Association (MACCA) (24)	Sarasota Jeff Sonne	Mechanical Ventilation Costs and Failure Rates in Florida Homes	This [presentation] was a gut punch-- now what should we do?; Inspectors don't know what to look for when inspecting mechanical ventilation systems; One individual stated he thought ventilation is needed.
Apr. 12, 2016	ASHRAE Space Coast Chapter and ASME Cape Canaveral Chapter (17)	Melbourne Rob Vieira	Mechanical Ventilation Costs and Failure Rates in Florida Homes	General reaction of not being surprised by results of the studies.
April 13, 2016	Florida Fire Marshal's And Inspectors Association and local AHJ's – Central Florida (about 25)	Sanford Rob Vieira	The Economic Impact of Building Code Change Requiring a 2nd Fire Access Elevator in Florida High Rise Structures	For extra-large people, EMTs may need large stretchers and elevators that can accommodate; Not convinced that there was sufficient reason to put the 2nd FSAE in the ICC, particularly for sprinkled buildings as low as 120'. Maybe 240' would make

				more sense; FSAE help get personnel up and down quickly and they carry heavy equipment and without elevators you need more personnel as even firemen in good shape get winded climbing the stairs. There is economic cost to having more personnel;; Need to educate fire emergency personnel about fire service access elevators and how they differ from standard elevators with fire personnel keys. Most firemen don't know.
May 5, 2016	Webinar (4)	Mike Houston Rob Vieira	The Economic Impact of Building Code Change Requiring a 2nd Fire Access Elevator in Florida High Rise Structures	Audience had no comments.

Economic Impact

The economic impact of the code changes to the State of Florida conducted include the following aspects:

1. The initial capital cost to implement the change on each building. This is the cost for extra air sealing, blower door testing, installation of a mechanical ventilation system; complying with the 2nd fire service access elevator including all lobby, hoistway, generator and other related requirements. This includes the extra labor and material purchases required to meet the code and is considered *the direct economic impact*.
2. The builder/developer markup or gross profit. This is another form of *direct economic impact*.
3. The lost revenue from lost sales due to an increased price to cover the code changes. This is another form of *direct economic impact*.
4. The effects of local inter-industry spending through the backward linkages. This is considered the *indirect impact*.
5. The results of local spending of employee's wages and salaries for both employees of the directly impacted industry, and the employees of the indirectly affected industries. This is referred to as the *induced impact*.

Other economics were beyond the scope of this study. These include:

1. The health, safety or energy benefit due to the code change. This would be a recurring value provided. Health benefits for these subjects are hard to quantify due to lack of studies.
2. The extra maintenance cost of a whole-house mechanical ventilation system or a second fire service access elevator. These would be costs after implementation, and would result in service jobs which in turn would benefit the economy.

3. Any increased cost due to construction delays related to the code changes.

For the residential analysis, lost sales were determined as follows. As a result of the increased costs the overall cost of each new home increases. This results in lost sales as people get priced out of buying a house. For $1000 increase in price, 125 fewer Florida new homes are sold[15] . Further, for the state of Florida it is estimated that the median sales price of a new home is $319,174[16] of which for this study $211,298 is attributed to construction costs and $45,000 is attributed to gross margin with the remaining in fees and site expenses.[17] Hence, for each house not sold the construction cost lost is modelled as a decrease in the construction of new residential permanent site single and multi-family structures while gross margin lost is modelled as a reduction in the industry spending pattern.

For the high-rise buildings it was difficult to make a case for lost revenue due to the relatively small cost of the 2nd FSAE relative to the overall project. Consider the following example:

<u>Lost lease space example -20 stories, 50 square feet per floor loss, high rent district:</u>

Leasable space: 10,000sf/floor x 20 floors = 200,000sf
Lost leasable space: 50sf/floor x 20 floors = 1,000sf
Magnitude of the lost sf: 1,000/200,000 = .005
Lease rate: @ $35/sf [current state average is $17.28 for office buildings –see Task 3 background section of this report]
Lost lease: 1000*35 =$35,000
Original Total lease: 200,000*$35= $7,000,000
Total lease if loss of space 199,000*$35= $6,765,000
Increased lease rate required to make up for loss: $35 x .005 =$0 .175 which is less than a quarter and well within the range of monthly fluctuation of rental rates.

If an entire 150 square feet per floor was needed, this value would triple to about $0.50 for this high rent example. For 150 square feet at the state-wide office rent value, it would be $0.25. For the 50 square foot example it would be less than a dime at the state-wide office rent. Thus, the difference in rent due to the minimal lost floor area would be negligible given all the other variables that would go into the equation to determine the rental cost.

So the economic analysis incorporates lost sales for the residential analysis but does not for the high rise.

Details of the assumptions, basis and modeling tool used for the economic analysis are provided in Appendix N. Table 19 lists the net annual effect on the state economy based on 70,000 housing starts and 34 high rise structures 120’ tall or taller. As a whole, the positive effect of jobs sustained lead to an overall benefit. However, some aspects are more beneficial while others are

[15] According to communication with David Crowe at the National Association of Homebuilders
[16] Ibid, unpublished data
[17] Amounts vary but these estimates seemed reasonable for some parts of the state according to Mike Hickman of Hickman Homes

less so. The air sealing and blower door are labor intensive but not very high cost and lead to greater benefit from a state-wide view. The mechanical ventilation requirement, as well as the additional HVAC requirements that may result from including a whole-house mechanical ventilation system, show a slight net negative effect prior to considering gross margin.

Table 19. The Overall Economic Impact to Florida of Potential Code Changes

Code	Response	Gained	Lost
Elevator- Highrise (403.6.1)	Answer (08)	$2,788,000	
Elevator- Highrise (403.6.1)	Answer (11)	$771,800	
Extra Air Sealing (R402.4.1.2)	Construction Cost	$35,000,000	-$15,847,350
Extra Air Sealing (R402.4.1.2)	Gross Margin	$7,000,000	-$3,375,000
Blower Door (R402.4.1.2)	Construction Cost	$21,000,000	-$9,508,410
Blower Door (R402.4.1.2)	Gross Margin	$4,200,000	-$2,025,000
Mechanical Vent (R303.4)	Construction Cost	$13,125,000	-$15,847,350
Mechanical Vent (R303.4)	Gross Margin	$7,000,000	-$3,375,000
Other Changes Due to Mech Vent (R303.4)	Construction Cost	$21,000,000	-$25,355,760
Other Changes due to Mech Vent (R303.4)	Gross Margin	$11,200,000	-$5,400,000
	Total	$123,084,800	-$80,733,870

Summary and Conclusions

There are a number of considerations regarding these three controversial changes for Florida's Building Code. The legislature in HB 535 addressed these changes in a manner that showed some balance between advocates of no requirements and those suggesting reasons for the requirements by still requiring mechanical ventilation for homes below 3 ACH50 while indicating the next code would test for air tightness at 7 ACH50, slightly looser than the 5 ACH50 of the IECC. Second fire service access elevators will remain part of the code, but requirements for the fire service access elevators have been made more flexible.

Air sealing of homes takes place now. Air sealing is done largely for energy savings but also can provide other benefits such as reducing sources of moisture and pollutants. The air sealing measures incorporated under the present and recent Florida codes were estimated by the survey respondents to cost about $500 for an example new, Florida Code compliant, single-story, single family detached, concrete block, all electric (heat pump, water heater, and all appliances) house with 2,000 ft^2 of conditioned area, 9' ceiling height, 3 bedrooms, and 2 baths (survey example). Most survey respondents thought no additional air sealing would be needed to reach the 5 ACH50 code level, however some thought it might cost more, about $500 for those thinking it would.

Blower door testing of the example residence was estimated at $300 by more experienced testers and the last job reported by these same survey takers was $250 with the middle 80% indicating the last job was from $125 to $1200. Key factors that might increase cost included the readiness of the home for testing and whether the home needed retesting. Five percent of respondents thought it might take more than five days to receive results, while 34% thought it would be the same or next business day. Those respondents that conducted blower door testing felt they could do much more work than presently and would hire more staff and purchase more equipment if business doubled. The blower door and air sealing requirements were seen as beneficial by 45% of respondents. Many felt testing was not necessary for code houses, houses were already tight. Others did not like that testing would lead to required mechanical ventilation systems.

From a state perspective the $300 for the blower door test does not lead to very many unqualified homebuyers. Since the funds are largely all spent on local labor there is a net benefit to the state estimated at $14,000,000.

Whole-house mechanical ventilation is incorporated in codes and standards as a health benefit measure. Tight houses need fresh air to remove pollutants. Pollutants can include VOCs. Infiltration alone, even in looser houses is not consistent. Depending on air infiltration locations, as well as leakage paths, a negative pressure whole-house ventilation system may introduce pollutants. Whole-house mechanical ventilation requires some maintenance, including usually changing of filters at outdoor air entry points. Outdoor air may have its own pollutants if near roadways or industrial areas or during times of fires. Allergens may be an issue at times, and in Florida, moisture is a prime concern.

Mechanical ventilation of homes is seen as not beneficial by over 60% of survey respondents. The industry is using different types of systems. The major concern of the many unfavorable comments received in the survey are directed towards 1) cost of the systems, and 2) more humid air would be introduced and it might lead to comfort, mold and/or energy issues. Many indicated there were types of systems they would not use, including the low cost exhaust-only fan.

The estimated average cost among the more experienced survey takers for purchase and installation of a whole-house mechanical ventilation system for the example new 2,000 ft2 home was $500 with a middle 80% range among all respondents with some experience of $150 to $3500. The costs of the survey respondents' most recent job was $365 for the most experienced with a middle 80% of respondents range of $150 to $8000. The larger range may be to the great variability in the most recent job.

Whole-house mechanical ventilation system installation may alter other HVAC system components. About 60% thought it would, 28% thought not, and 12% indicated they were not sure. Of those more experienced, there was a slight majority thinking *no*. Of the more experienced answering *yes*, the median cost of the other changes was $800. The range of all respondents with one or more jobs was rather large. The middle 80% of respondents went from $400 to $3500. On average the most recent job was similar with a median of $880 among the more experienced group and a range of $250 to $4000 for the middle 80% of all respondents with some experience.

The cost of the mechanical ventilation installations would increase labor and have some benefit in terms of jobs due to increased construction spending. However, these would be balanced by fewer housing starts due to increased cost of housing.

This economic impact presented does not examine health benefits. Due to the high cost of health care, if hospital visits or disability of even small fractions of the population result from lack of sufficient fresh air, the economics of whole-house mechanical ventilation systems might be quite different.

The second fire service access elevator was put into IBC codes as a desire for redundancy and is based on a survey conducted by proponents of fire professionals. Our survey indicated a slight majority of respondents did not like the code change. The major complaint of those not liking the change was its cost. Many also felt it was not needed. Others felt it should be more limited in scope (larger buildings only). Some were supportive of the change.

Deliverables

The project includes interim and final report deliverables.

Deliverable #1 Interim Report

A draft report providing technical information on the problem background and resulting economic information gathered for each of the three delayed code requirements will be submitted by November 15, 2015. The report will be presented to the Commission or Commission's appropriate Technical Advisory Committee at a time agreed to by the Contractor and the Department's Project Manager.

- Interim report was delivered November 13, 2015.

- Presentation to Mechanical, Fire and Energy TACs were conducted in December, 2015. The presentations included the interim report and highlights of the survey returns.

Deliverable #2 Final Report

A final report providing background data/information, analysis, results, minutes from the stakeholder events and implication by May 15, 2016. The report will be presented to the Commission or Commission's appropriate Technical Advisory Committee at a time agreed to by the Contractor and the Department's Project Manager.

- The final report was sent in May 13, 2016. Presentations are scheduled with the TACs in early June. Minutes were not always taken by the meeting organizers at stakeholder meeting but comments were gathered and included in this final report under the Task 4 description.

Project Completion Update

With the acceptance of this report and the presentations, this project has met all deliverables.

Additional Pertinent Information / Cost Overrun Explanation

The project was completed for the costs budgeted.

Relevant Work Products

Advisory committees were formed (agendas in Appendices C and H) and online meetings held to obtain input for survey and project. Background research was conducted. Two online surveys were developed 1) a blower door testing and mechanical ventilation survey and 2) a fire service access elevator survey. Analysis of the survey responses is provided in this report. The survey instruments and tabulated results are provided in the Appendix. A statewide economic impact analysis of direct, indirect and induced costs was conducted. Those results are included in this report. Presentations were prepared and given to industry groups and their feedback was summarized in this report.

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Appendices

Appendix A: Relevant Florida Building Code References

Appendix B: Home Ventilating Institute Position Paper:
The Case for Mechanical Ventilation and Air Tightness Requirements in Florida

Appendix C: Residential Industry Advisory Committee Meeting Announcements and Agendas

Appendix D: Residential Construction Survey Instrument with Logic
and Survey Invitation Email Text

Appendix E: Residential Construction Survey Summary Report

Appendix F: Residential Construction Survey Multiple Choice Questions Cross Tabulated by Profession

Appendix G: Residential Construction Survey Comments

Appendix H: Access Elevator Industry Advisory Committee Meeting Announcements and Agendas

Appendix I: Access Elevator Survey Instrument with Logic

Appendix J: Access Elevator Survey Instrument Summary Report

Appendix K: Access Elevator Survey Multiple Choice Questions Cross Tabulated by Profession

Appendix L: Access Elevator Survey Comments

Appendix M: Access Elevator March 29, 2016 Webinar Q and A Session Transcript

Appendix N: Statewide Direct, Indirect and Induced Economic Impact Report

Appendix A:
Relevant Florida BuildingCode References

- Excerpt 1 from the Florida Building Code, Energy Conservation, 5th Edition (2014):

> "R402.4.1.2 Testing.
> The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.
>
> "During testing:
> 1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures;
> 2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures;
> 3. Interior doors, if installed at the time of the test, shall be open;
> 4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
> 5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
> 6. Supply and return registers, if installed at the time of the test, shall be fully open.

- Excerpt 2 from the Florida Building Code, Residential, 5th Edition (2014):

> "R303.4 Mechanical ventilation. Where the air infiltration rate of a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section R402.4.1.2 of the Florida Building Code, Energy Conservation the dwelling unit shall be provided with whole-house mechanical ventilation in accordance with Section M1507.3.

- Excerpt 3 from the Florida Building Code, Building, 5th Edition (2014):

> "Section 403 High Rise Buildings
> "403.6.1 Fire service access elevator. In buildings with an occupied floor more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, no fewer than two fire service access elevators, or all elevators, whichever is less, shall be provided in accordance with Section 3007. Each fire service access elevator shall have a capacity of not less than 3500 pounds (1588 kg).

Appendix B:

Home Ventilating Institute Position Paper

The Case for Mechanical Ventilation and Air Tightness Requirements in Florida

The Case for Mechanical Ventilation and Air Tightness Requirements in Florida

By Mike Moore, P.E.

Overview

To safeguard public health and promote energy savings and affordability, Florida should maintain the model building code requirements of 5 air changes per hour at 50 pascals (5 ACH50) for building air tightness verification and mandatory requirements for whole-house mechanical ventilation for the following reasons:

1. New, energy efficient and durable construction is by nature tight construction. Studies have shown that in Florida, new homes typically have an air tightness between 3 and 6 air changes per hour at 50 pascals ("ACH50").[3]
2. For construction with an air tightness below 10 ACH50, controlled mechanical ventilation is needed to deliver the minimum air change rate recommended by national consensus-based codes and standards.
3. Reducing the stringency of the code requirement for mechanical ventilation is in direct opposition to national codes and standards which require mechanical ventilation in the interest of public health. Proposals to strip the code of this public safeguard are based solely on expediency and first costs with no consideration for the research and data that point to significant health costs linked to poor indoor air quality and inadequate ventilation.
4. The building tightness and mechanical ventilation requirements in model code language have been developed through a multi-step process that involves expert testimony, public hearings, builder input (builders hold more committee seats than any other group on the model code committees), and the final oversight of government public safety officials. Prior to model codes being adopted in Florida, this process is repeated again through the leadership of the Florida Building Commission. HB 535 and SB 704 seek to override this entire process by proposing politically expedient rollbacks in provisions of the code that are intended to safeguard public health. Flint, Michigan provides an excellent example of the dire consequences that can result from pursuing politically expedient measures that run counter to considerations for public health.

Flint, Michigan provides an excellent example of the dire consequences that can result from politically expedient measures that run counter to considerations for public health.

Florida Homes Are Built Tight and Need Mechanical Ventilation to Meet National Standards for Minimum Acceptable Indoor Air Quality

Code requirements and modern building practices are resulting in homes being built tighter today than ever before. Building a tight home is good practice from both an energy efficiency and a durability perspective. Since 2010, the Florida Building Code has included prescriptive air sealing requirements.[1] The 2010 code included an air leakage testing option stating, "Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than seven air changes per hour when tested with a blower door at a pressure of 50 pascals."[2] As previously indicated, the current Florida code requires air leakage to be 5 ACH50 or below. Simply following Florida's code language that has been in place since adopting the 2010 code will result in homes regularly testing around 5 ACH50.

National codes and standards set a target of 0.35 natural ACH for the *minimum* combined infiltration and ventilation rate (i.e., "fresh air" rate). To achieve this rate without using mechanical ventilation, a home would have to have an air leakage exceeding 10 ACH50, which would represent poor construction compromising the safety, durability, and performance of the building, in addition to not meeting Florida's code requirements since 2010. Based on studies sampling over 15,000 dwelling units built since 1987, Florida's current building practices and codes have resulted in homes regularly achieving an air tightness between 3 and 6 ACH50.[3] Table 1 provides a summary of the seasonal and average fresh air rates experienced by a typical single family home in Florida that can be expected at various air tightness levels without including mechanical ventilation. Absent mechanical ventilation, typical homes in Florida would have 40% to 65% less fresh air than the minimum targeted fresh air rate in model codes and standards. If the Florida legislature elects

Florida's Homes Are Too Tight not to Specify Mechanical Ventilation!

- Homes are and will continue to be built tightly due to good building practices and updated codes and standards.
- Without mechanical ventilation, a Florida home would have to have air leakage exceeding 10 ACH50 to provide the minimum annual rate for acceptable indoor air quality.
- Air tightness studies of Florida homes built since 1987 have returned an average of 3.2-6.1 ACH50.[3]
- If the Florida legislature elects to roll back the mechanical ventilation requirement to 3 ACH50 and below, they will reduce the fresh air rate by up to 65% of that promulgated by codes and standards to maintain a minimum level of acceptable indoor air quality.

[1] Table R402.4.2 of the 2010 Florida Building Code: Energy Conservation and Table R402.4.1.1 of the 2014 Florida Building Code: Energy Conservation.
[2] http://publicecodes.cyberregs.com/st/fl/st/b1500v10/st_fl_st_b1500v10_4_par033.htm?bu=FL-P-2010-000011
[3] Vieira R, Sonne J, McIlvane J, & Sutherland K. 2015. Evaluating the Economic Impacts of the Legislatively Delayed Provisions of the 5th Edition (2014) Florida Building Code, Interim Progress Report. Presentation to the Florida Building Commission Mechanical Technical Advisory Committee.

to roll back the mechanical ventilation requirement to 3 ACH50 and below, they will reduce the fresh air rate by up to 65% of that promulgated by codes and standards to maintain a minimum level of acceptable indoor air quality.

	Average Fresh Air Changes Per Hour [Annual Target in Codes and Standards = 0.35 Fresh Air Changes Per Hour]					
Building Air Tightness (ACH50)	Winter	Spring	Summer	Fall	Annual	% Less than Code and Standard Minimum
3	0.15	0.11	0.09	0.13	0.12	65%
5	0.23	0.17	0.13	0.19	0.18	49%
6	0.27	0.19	0.16	0.22	0.21	40%
7	0.31	0.22	0.18	0.25	0.24	31%
10	0.42	0.31	0.25	0.35	0.33	5%

Table 1. Deficiency of natural ventilation to achieve the code- and standard-targeted minimum rate for fresh air (i.e., 0.35 air changes per hour). Values were calculated using the U.S. Department of Energy's EnergyPlus software to model a typical 2,600 ft^2, three-bedroom, single-family home in Orlando, FL.

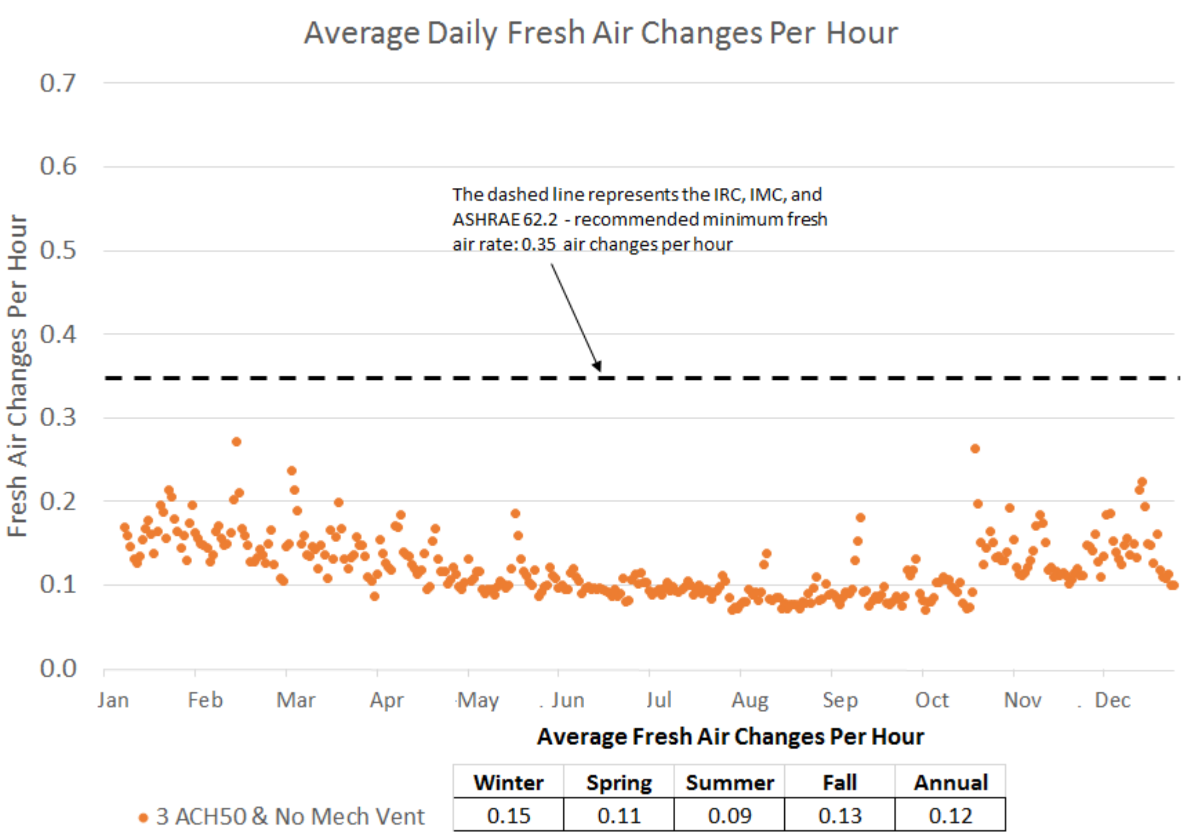

Figure 1. At 3 ACH50, the average annual fresh air changes per hour is 0.12, which is 65% less than promulgated by codes and standards to provide minimum acceptable indoor air quality. In the summer, when indoor formaldehyde levels are generally their highest, the average fresh air rate of a 3 ACH50 home with no mechanical ventilation dips to 0.09, which is 74% lower than the minimum target in model codes and standards.

Poor Indoor Air Quality Means Big Public Health Costs

The biggest health benefit of mechanical ventilation relates to improvements in indoor air quality. Indoor air can be many times more polluted than outdoor air, and the average American spends 90 percent of the day inside. Ventilation systems can significantly improve a home's air quality by removing allergens, pollutants, and moisture that can cause mold problems.

When homes rely solely on air leakage through walls, roofs, and windows to provide fresh air, there is no control over the source or volume of air that comes into the house. In fact, air leaking into the house may come from undesirable areas such as the garage, attic, or crawl space. Common indoor air pollutants in new homes include biological pollutants (mold spores, dust mites, bacteria, viruses, pollen, animal dander); combustion pollutants (including carbon monoxide, nitrous oxides, and particulate matter); volatile organic compounds (VOCs) emitted from many paints, glues, and other building materials (this is called "off-gassing"); and, in some areas of Florida, radon.[4] Another contributor to poor indoor air quality in Florida is moisture. When done well, proper ventilation will assist in pollutant and moisture removal and control.

If Florida's legislature elects to roll back the mechanical ventilation requirement to only apply to homes tighter than 3 ACH50, studies indicate that the net effect will increase occupant formaldehyde exposure by 40% or more, with higher spikes expected in hot humid summer conditions when formaldehyde emissions are highest.[5]

Mechanical Ventilation is Necessary for Healthy Indoor Air

- Helps remove harmful allergens, pollutants, and moisture from homes.
- Provides fresh air in accordance with model codes and standards minimum requirements.
- Provides more balanced fresh air rates across all seasons.
- Helps mitigate risk of formaldehyde emissions and concentrations.
- Helps improve occupant health issues such as asthma and other respiratory issues.

[4] Source:http://www.myfloridahomeenergy.com/help/library/hvac/ventilation/#sthash.Bvb08KuX.dpbs

[5] Hult EL, Willem H, Price PN, Hotchi T, Russell ML, and Singer BC. 2015. Formaldehyde and acetaldehyde exposure mitigation in US residences: in-home measurements of ventilation control and source control. Indoor Air 25:523-535. The 40% increase is the effect of moving from 0.35 air changes per hour to 0.12 air changes per hour based on Figure 4 of the report.

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Various studies have identified major costs associated with the negative health effects of poor indoor air quality. In fact, research suggests that poor IAQ is responsible for around $500 annually in health related costs per person in the U.S., which translates to $10 billion annually in Florida.[6,7,8,9,10] According to a U.S. Department of Energy study, the first costs associated with a mechanical ventilation system can be as low as $350[11], which works out to less than $19 per year when amortized over a 30-year loan at 3.5%. Assuming an average household size of 2.54 people, the cost to maintain minimum acceptable indoor air quality is less than $8 per year per person. This investment in public health pales in comparison to the $500 per year estimate of health related costs associated with poor IAQ.

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The Code Development Process is Sound and Should not be Overwritten by the Legislature

Model building code language is a result of a process that considers expert testimony and diverse opinions from all stakeholders. Model code requirements are what industry experts identify as the minimum requirements for new homes to ensure they are built to today's construction standards.

The International Code Council (ICC) develops the model codes and uses a process where input from both their voting members and all stakeholders are taken into account before making any changes. Anyone who wishes to submit a code proposal, or change to an existing code requirement may do so. Proposals are first heard by a code development committee focusing on a specific topic area. In this particular case, proposals to amend blower door testing requirements would be heard by the energy committee, while changes to the mechanical ventilation requirements would be heard by the residential code committee. Both of these committees have membership of code officials and industry professionals, with builders being a primary stakeholder on each. After the committee votes on a proposal, anyone can submit a public comment to alter the committee's decision. Uncontested decisions are passed via a consensus vote at the second hearing by ICC membership. Contested decisions are reviewed and must be considered individually by ICC membership and passed at the second hearing. ICC

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[6] Logue JM, Price PN, Sherman MH, & Singer BC. 2012. A Method to Estimate the Chronic Health Impact of Air Pollutants in U.S. Residences. Environmental Health Perspectives 120(2): 216-222.
[7] Turner WJN, Logue JM, and Wray CP. 2012. Commissioning Residential Ventilation Systems: A Combined Assessment of Energy and Air Quality Potential Values. LBNL-5969E.
[8] Brown DW. 2008. Economic value of disability-adjusted life years lost to violence: estimates for WHO Member States. Rev. Panam Salud Publica, 24, 203-209.
[9] Lvovsky K, Huges G, Maddison D, Ostro B, and Pearce D. 2000. Environmental costs of fossil fuels: a rapid assessment method with application to six cities. Washington, D.C.: The World Bank Environment Department.
[10] Highfill T and Bernstein E. 2014. Using Disability Adjusted Life Years to Value the Treatment of Thirty Chronic Conditions in the U.S. from 1987-2010. U.S. Department of Commerce Bureau of Economic Analysis WP 2014-9.
[11] http://www.floridabuilding.org/fbc/commission/FBC_1215/Fire_TAC/EconomicImpactDealyedCodeInterimReport_Nov2015.pdf

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membership, composed of governmental officials whose primary interest are public health and life safety, have the final determination of what changes are made to the code. These changes are vetted on a national level.

The ICC is a Trusted Industry Source

Codes and standards adopted by the International Code Council (ICC) undergo a lengthy review and comment period. ICC codes are:

- Innovative and coordinated
- Are efficient and effective.
- Are developed through the efforts of public safety officials.
- Are up to date and state of the art.
- Are revised every 18 months, and new editions are published every three years.
- Are economically viable and practical.

Source: *http://www.iccsafe.org/codes-tech-support/codes/code-development/code-*

The requirements for mechanical ventilation were introduced during the 2012 ICC code cycle process. The IRC Development Committee (which included several builder representatives) reviewed these changes in 2009, and the final version of the change was passed in May of 2012. The requirement for blower door testing and air tightness of 5 ACH50 was introduced during the same cycle, and the final version was passed in October of 2012. Changes for both mechanical ventilation and mandatory air tightness testing were introduced at the same time in recognition that both building codes and modern building practices had established a need to use mechanical ventilation to provide fresh air in homes. *The code requirement for whole house mechanical ventilation was specifically set at 5 ACH50 or tighter because all homes adopting this code would also need to be tested and achieve a 5 ACH50 or tighter envelope air tightness.* These two requirements need to be coordinated because all newly constructed homes (even homes leakier than 5 or 7 ACH50) need ventilation in order to provide acceptable indoor air quality. Since 2012, the code requirements for air tightness and mechanical ventilation have been challenged and upheld through the ICC code hearing process two additional times, carrying through to the 2015 and 2018 versions of the codes.

Prior to the adoption of model codes at the state level, the Florida Building Commission conducts a rulemaking process that considers the merits of state specific amendments. This process includes public comment periods, Commission meetings, and recommendations developed by appointed representative stakeholder groups. In late 2015, the FBC initiated a rulemaking process for the most recent model codes, and several parties have submitted proposals to change the mechanical ventilation requirement and blower door requirement. Most of these proposals have been submitted by a consultant who has been retained by the Florida Home Builders Association. In other words, builders are currently exercising their opportunity to have their position on mechanical ventilation and air tightness heard through an established and official process within the State of Florida. The Florida Building Commissions' rulemaking process, not the legislature, is the venue where building code proposals should be and are being heard.

Legislators are encouraged to support the model code process and not override it as there is a technical and consensual basis for requiring tight homes and mechanical ventilation. There have been numerous studies exemplifying the positive attributes of tight home construction which embrace the use of mechanical ventilation to maintain proper indoor air quality, resulting in the industry mantra, “Build tight, ventilate right.”

The Florida Building Commissions’ rulemaking process, not the legislature, is the venue where building code proposals should be and are being heard.

The Code Represents Compromise

As they pertain to Florida, the model code requirements for both building air tightness and mechanical ventilation already represent a compromise. Understanding that infiltration and ventilation is climate dependent, the code requirements vary based on climate zone. For hot, humid climates like Florida (Climate Zones 1 & 2) the air tightness target was set to 5 ACH50. In Climate Zones 3-8, which represents the vast majority of the country, the code requires 3 ACH50.

Additionally, the national consensus standard on indoor air quality, ASHRAE 62.2, requires mechanical ventilation for *all* conditioned dwelling units, regardless of building tightness. However, the International Residential Code only requires mechanical ventilation for units at 5 ACH50 or less. When approving this requirement, the International Residential Code committee stated, “The proposed threshold is appropriate for determining where mechanical ventilation is required.” This comment considered the nation as a whole, where dwelling units achieving an air tightness target of 5 ACH50 *and* providing mechanical ventilation can be expected to provide acceptable indoor air quality on average.

To date, over a dozen states have adopted code language requiring air tightness testing at or below 5 ACH50 and mechanical ventilation for residential dwelling units, including Alabama and Texas, which like Florida have large populations in Climate Zone 2.

Summary

The model code requirements for mechanical ventilation and building air tightness have been developed through an open and consensus-based process that gives ample opportunity for amendments with a sound technical basis. The mechanical ventilation requirement was introduced to safeguard public health. A legislative action to roll back this provision without sound technical basis is imprudent at best and could be considered negligent or even injurious at worst. Any proposed amendments to the code provisions should continue to be heard through the state’s established process and not within the legislature.

About the Home Ventilating Institute

The Home Ventilating Institute (HVI), founded in 1955, is an international nonprofit association of the manufacturers of home ventilating products. HVI's core purpose is "To Make Indoor Air Healthier." Through its Certified Ratings Programs, HVI provides a voluntary means for residential ventilation manufacturers to report comparable and creditable product performance information based upon uniformly applied testing standards and procedures performed by independent laboratories. Certified performance ratings include airflow, sound and energy.

Today, HVI represents manufacturers from the United States, Canada, Asia and Europe, producing the majority of the residential ventilation products sold in North America. HVI certification is a prerequisite for obtaining the ENERGY STAR® rating for mechanical ventilation equipment.

HVI's Mission Statement

"We are champions of healthy indoor air working together to advance and promote dependable ventilation practices through product certification, consumer education, and codes and standards participation."

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Appendix C:
Residential Industry Advisory Committee Meeting Announcements and Agendas

Date: October 12, 2015
To: Industry Advisory Committee Members and Prospective Members
From: Robin Vieira, Director of Buildings Research
RE: Invitation, Initial Meeting, and Resources

We are pleased to invite you to sit on an Industry Advisory Committee for a study funded by the Florida Building Commission. The study is to evaluate potential economic impacts from implementation of two sections of the Florida Building Code, 5th Edition (2014) that the Florida legislature delayed until July 2016:

- Florida Building Code, Energy Conservation, 5th Edition (2014): Section R402.4.1.2 Testing - the air leakage testing requirement for residential buildings.
- Florida Building Code, Residential, 5th Edition (2014), Section "R303.4 Mechanical ventilation - the whole-house mechanical ventilation requirement for residential buildings.
- Full text included below for reference.

A key element of the study involves collecting input from a wide variety of stakeholders affected by the delayed provisions through two surveys – one dedicated to each delayed section. We want this survey to reflect as many different industry perspectives as possible. The Industry Advisory Committee will help ensure that no key stakeholder groups or potential economic impacts have been neglected.

Each member of the Industry Advisory Committee will be asked to participate in three ways:

1. Attend committee meetings in person or by phone
   First meeting: October 16, 2015, 12201 Research Pkwy Rm 211, Orlando, FL 32826
2. Review two draft surveys and advise of any confusion or deficiencies in writing
3. Review list of stakeholders we have identified – advise of any missing groups
4. Brainstorm distribution paths to reach each impacted group

The study must be completed in time to allow consideration by those proposing code modifications which are due by December 31, 2015; therefore, we anticipate that the work of this committee will be substantially completed by December 1, 2015.

Please note that the study will be restricted to the potential economic impacts. Though there may be technical implications related to the requirements for air tightness testing and mechanical ventilation, our funded scope of work does not include them.

Please RSVP to janet@fsec.ucf.edu your availability to attend the first Industry Advisory Committee meeting: October 16, 2015, 12201 Research Pkwy Rm 211, Orlando, FL 32826

Florida Building Code, Energy Conservation, 5th Edition (2014): Section R402.4.1.2

"R402.4.1.2 Testing.

The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

"During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures;
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures;
3. Interior doors, if installed at the time of the test, shall be open;
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

Reference:http://floridabuilding2.iccsafe.org/app/book/content/2014_Florida/Energy%20Conservation%20Code/Chapter%204[RE].html (accessed 10/12/15)

Florida Building Code, Residential, 5th Edition (2014), Section R303.4

"R303.4 Mechanical ventilation.

Where the air infiltration rate of a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section R402.4.1.2 of the Florida Building Code, Energy Conservation the dwelling unit shall be provided with whole-house mechanical ventilation in accordance with Section M1507.3."

Reference:http://floridabuilding2.iccsafe.org/app/book/content/2014_Florida/Residential%20Code/Chapter%203.html (accessed 10/12/15)

Florida Building Code, Residential, 5th Edition (2014), Section M1507.3

"M1507.3 Whole-house mechanical ventilation system.

Whole-house mechanical ventilation systems shall be designed in accordance with Sections M1507.3.1 through M1507.3.3

M1507.3.1 System design.

The whole-house ventilation system shall consist of one or more supply or exhaust fans, or a combination of such, and associated ducts and controls. Local exhaust or supply fans are permitted to serve as such a system. Outdoor air ducts connected to the return side of an air handler shall be considered to provide supply ventilation.

M1507.3.2 System controls.
The whole-house ventilation system shall be provided with controls that enable manual override.

M1507.3.3 Mechanical ventilation rate.
The whole-house ventilation system shall provide outdoor air at a continuous rate of not less than that determined in accordance with Table M1507.3.3(1).

Exception: The whole-house ventilation system is permitted to operate intermittently where the system has controls that enable operation for not less than 25-percent of each 4-hour segment and the ventilation rate prescribed in Table M1507.3.3(1) is multiplied by the factor determined in accordance with Table M1507.3.3(2).

Table M1507.3.3(1) CONTINUOUS WHOLE-HOUSE MECHANCIAL VENTILATION SYSTEM AIRFLOW RATE REQUIREMENTS

DWELLING UNIT FLOOR AREA (square feet)	**NUMBER OF BEDROOMS**				
	0-1	**2-3**	**4-5**	**6-7**	**>7**
	Airflow in CFM				
< 1,500	30	45	60	75	90
1,500 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 6,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
>7,500	105	120	135	150	165

For SI: 1 square foot – 0.0929m^2, 1 cubic foot per minute = 0.0004719 m^3/s

Table M1507.3.3(2) INTERMITTENT WHOLE-HOUSE MECHANCIAL VENTILATION RATE FACTORS[a,b]

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor[a]	4	3	2	1.5	1.3	1

a. For ventilatin system run time values between those given, the factors are permitted to be dertermined by interpolation.
b. Extrapolation beyond the table is prohibited.

Reference:http://floridabuilding2.iccsafe.org/app/book/content/2014_Florida/Residential%20Code/Chapter%2015.html (accessed 10/12/15)

Agenda

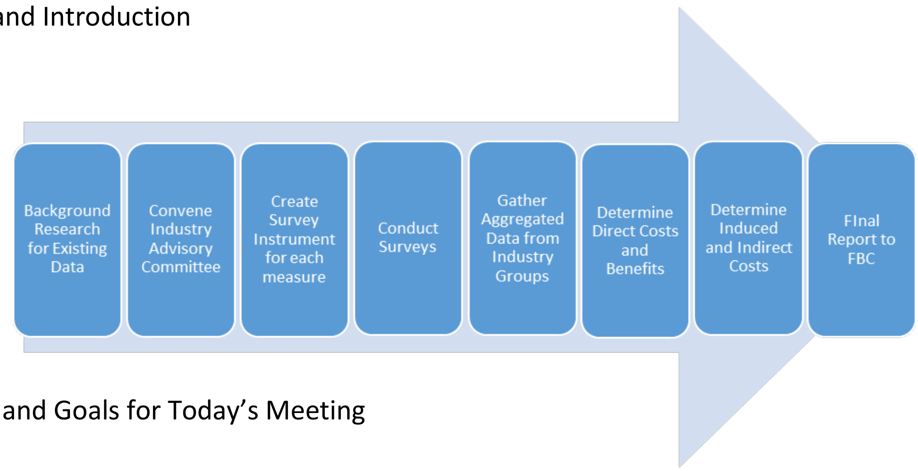
Residential Industry Advisory Committee Meeting

in support of Florida Building Commission research project:

Evaluating the Economic Impacts of the Legislatively Delayed Provisions of the 5th Edition (2014) Florida Building Code

October 16, 2015

Welcome and Introduction



Objectives and Goals for Today's Meeting

Topic 1: Blower Door Testing
- Review delayed code language - Q&A
- Brainstorm stakeholders that will be financially impacted
- Clarify in what way stakeholders are expected to be impacted
- Brainstorm ways to reach each stakeholder & who might have aggregated data

Topic 2: Mechanical Ventilation
- Review delayed code language - Q&A
- Brainstorm stakeholders that will be financially impacted
- Clarify in what way stakeholders are expected to be impacted
- Brainstorm ways to reach each stakeholder & who might have aggregated data

Topic 3: Draft Surveys
- Objective of surveys
- How survey data will be used
- Procedures
- Review of Blower Door Testing Survey
- Review of Mechanical Ventilation Survey

Appendix D:
Residential Construction Survey Instrument with Logic and Survey Invitation Email Text

Share your knowledge and views in an online survey so the Florida Building Commission can make informed decisions for the next Building Code. The University of Central Florida, under the direction and funding of the Florida Building Commission, is collecting input about the cost and other relevant factors related to:

- Whole-house air sealing (excluding duct sealing)
- Whole-house air tightness testing (referred to as blower door testing, which does not include duct testing)
- Residential whole-house mechanical ventilation systems (excluding occupant controlled spot ventilation in kitchens and bathrooms)

Survey respondents are anonymous. The amount of time it takes to complete will vary based on your involvement level in these three areas of interest. Deadline for completion is 5pm, Nov. 20, 2015. Take the survey here http://fsec.ucf.edu/go/rescode.

To report problems with the online survey, please contact Jeff Sonne, Senior Research Engineer at the Florida Solar Energy Center, A Research Institute of the University of Central Florida at 321-638-1406.

Industry Survey Concerning New Florida Residential Construction

[Note: text with blue background below indicates survey logic used to determine which questions respondents see based on previous answers; this text is not visible to respondents.]

This survey concerns ONLY new residential construction (three stories or less) and ONLY in Florida. The University of Central Florida, under the direction and funding of the Florida Building Commission, is collecting input about the cost and other relevant factors related to:

- Whole-house air sealing (excluding duct sealing)
- Whole-house air tightness testing (referred to as blower door testing, which does not include duct testing)
- Residential whole-house mechanical ventilation systems (excluding occupant controlled spot ventilation in kitchens and bathrooms)

Survey results will be used in an assessment of the potential economic impact of two Florida Building Code provisions that the Florida legislature delayed until June 30, 2016:

- Florida Building Code, Energy Conservation, 5th Edition (2014): Section R402.4.1.2 - This provision states that the building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour [at 0.2 inches w.g. (50 Pascals) -also known as 5 ACH50]. See Section R402.4.1.2 full text
- Florida Building Code, Residential, 5th Edition (2014), Section R303.4 – This provision requires whole-house mechanical ventilation for houses with ACH50 of less than 5. See Section R303.4 full text
- Additionally, Section R303.4 refers to Section M1507.3 which sets whole-house mechanical ventilation system requirements. See Section M1507.3 full text

Respondents may skip any question; however, skipping key questions may prevent you from seeing more detailed questions. That is, some survey questions will not be displayed depending on answers to preliminary questions. The survey is anonymous.

The survey automatically saves your answers. You can return later (from the same computer) to complete or change your answers for 1 week until the survey closes on November 20.

To report problems or malfunctions in the online survey, please contact Jeff Sonne at Florida Solar Energy Center at 321-638-1406. Thank you.

Part 1 - About Your Business

Have you been involved in the construction of new Florida homes over the PAST TWO YEARS?
- ❍ Yes
- ❍ No

Answer If Have you been involved in the construction of new Florida homes over the past two years? Yes Is Selected

Please list the Florida counties you serve (select all that apply):

- ❑ Alachua
- ❑ Baker
- ❑ Bay
- ❑ Bradford
- ❑ Brevard
- ❑ Broward
- ❑ Calhoun
- ❑ Charlotte
- ❑ Citrus
- ❑ Clay
- ❑ Collier
- ❑ Columbia
- ❑ DeSota
- ❑ Dixie
- ❑ Duval
- ❑ Escambia
- ❑ Flagler
- ❑ Franklin
- ❑ Gadsden
- ❑ Gilchrist
- ❑ Glades
- ❑ Gulf
- ❑ Hamilton
- ❑ Hardee
- ❑ Hendry
- ❑ Hernando
- ❑ Highlands
- ❑ Hillsborough
- ❑ Holmes
- ❑ Indian River
- ❑ Jackson
- ❑ Jefferson
- ❑ Lafayette
- ❑ Lake
- ❑ Lee
- ❑ Leon
- ❑ Levy
- ❑ Liberty
- ❑ Madison
- ❑ Manatee
- ❑ Marion
- ❑ Martin
- ❑ Miami-Dade

- ❑ Monroe
- ❑ Nassau
- ❑ Okaloosa
- ❑ Okeechobee
- ❑ Orange
- ❑ Osceola
- ❑ Palm Beach
- ❑ Pasco
- ❑ Pinellas
- ❑ Polk
- ❑ Putnam
- ❑ Santa Rosa
- ❑ Sarasota
- ❑ Seminole
- ❑ St. Johns
- ❑ St. Lucie
- ❑ Sumter
- ❑ Suwannee
- ❑ Taylor
- ❑ Union
- ❑ Volusia
- ❑ Wakulla
- ❑ Walton
- ❑ Washington

Are you a (an) (select all that apply):

- ❑ Home Builder
- ❑ HVAC Contractor
- ❑ Trade Contractor Other than HVAC, please describe: ______________________
- ❑ Certified Home Energy Rater
- ❑ Weatherization Industry Professional
- ❑ Other Blower Door Testing Provider
- ❑ Mechanical Engineer
- ❑ Code Official
- ❑ Other, please describe ______________________

Approximately how many blower door tests have you conducted or had conducted for new Florida homes you built or worked on over the PAST TWO YEARS? (Answer must be a single number e.g. 0, 25, 405):

Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the PAST TWO YEARS in new Florida homes? (Answer must be a single number e.g. 0, 25, 405)

Part 2 - Estimated Cost for a Specific Example House for air sealing, blower door testing, and whole house mechanical ventilation

Questions in Part 2 are based on this PART 2 EXAMPLE HOUSE: A new, Florida Code compliant, single-story, single family detached, concrete block house, all electric (heat pump, water heater, and all appliances), with 2,000 ft2 of conditioned area, 9' ceiling height, 3 bedrooms, and 2 baths.

For reference: ACH50 refers to the air leakage rate measured using a blower door at 0.2 inches w.g. (50 Pascals).

AIR SEALING

Estimate the cost ($) to the builder for typical air sealing measures for the EXAMPLE HOUSE built to the Florida Code's MINIMUM REQUIREMENTS. (See Table R402.4.1.1 Air Barrier And Insulation Installation of the Florida Building Code, Energy Conservation, Chapter 4, full text). (Answer must be a single number e.g. 0, 25, 405)

Would any additional air sealing be necessary to reach the required blower door test result of no greater than 5 ACH50.
- ❍ Yes, in many or all cases.
- ❍ No, unlikely for most homes
- ❍ I don't know

Answer If Would any additional air sealing methods be necessary to reach the required blower door test result of no greater than 5 ACH50. Yes, in many or all cases. Is Selected

If yes, please estimate the additional cost ($). (Answer must be a single number e.g. 0, 25, 405)

Answer If Would any additional air sealing methods be necessary to reach the required blower door test result of no greater than 5 ACH50. Yes, in many or all cases. Is Selected

Please describe the additional air sealing necessary to reach the required blower door test result of no great than 5 ACH50.

PART 2 EXAMPLE HOUSE: A new, Florida Code compliant, single-story, single family detached, concrete block house, all electric (heat pump, water heater, and all appliances), with 2,000 ft2 of conditioned area, 9' ceiling height, 3 bedrooms, and 2 baths.

BLOWER DOOR TESTING

Estimate the cost to builder for conducting a blower door test and all associated reporting and communications for the EXAMPLE HOUSE assuming it is within the tester's normal service area.

	Estimated cost to builder for testing, associated reporting, and all communications ($)	On-site time needed to conduct test (hours)	How long, if at all, would normal site activity need to stop for testing (hours)	Fee for retesting, if necessary ($)
For the EXAMPLE HOUSE (Answer must be a single number e.g. 0, 25, 405)				

Are there any factors that would warrant a substantial increase or decrease in your cost estimate for the EXAMPLE HOUSE?

❑ Increase ____________________

❑ Decrease ____________________

Estimate when the builder could expect to receive the testing results:

❍ The same or next business day

❍ 2 or 3 business days

❍ 4 or 5 business days

❍ More than 5 business days

❍ I don't know

PART 2 EXAMPLE HOUSE: A new, Florida Code compliant, single-story, single family detached, concrete block house, all electric (heat pump, water heater, and all appliances), with 2,000 ft2 of conditioned area, 9' ceiling height, 3 bedrooms, and 2 baths.

WHOLE HOUSE MECHANICAL VENTILATION SYSTEM

What type of 2014 Florida Code compliant whole-house mechanical ventilation system would you specify for the EXAMPLE HOUSE (select one answer):
- ❍ Exhaust only (excluding occupant controlled kitchen and bathroom fans)
- ❍ HRV (heat recover ventilator) or ERV (energy recovery ventilator)
- ❍ Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)
- ❍ Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)
- ❍ Other, please describe ____________________

Estimated cost ($) of this system to the builder including equipment and installation:

Comments on estimate:

Estimated time on-site in hours (Answer must be a single number e.g. 0, 25, 405)

Are there any factors that would likely warrant a substantial increase or decrease in your cost estimate for the EXAMPLE HOUSE?
- ❑ Increase ____________________
- ❑ Decrease ____________________

Q22 Would you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE?
- ❍ Yes
- ❍ No
- ❍ I don't know

Answer If Would you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE? Yes Is Selected

If you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE, please estimate the cost and describe the changes needed?
- ❑ Estimate cost ($) (Answer must be a single number e.g. 0, 25, 405) ____________________
- ❑ Describe the expense ____________________

Part 3 - Future Work with Blower Door Testing, and Whole-House Mechanical Ventilation

In Part 3, we'd like to ask about your anticipated FUTURE blower door testing and whole-house mechanical ventilation systems, again in new residential code (three stories or less) construction.

If blower door testing is required in the FUTURE, who would you expect to offer blower door testing services (select all that apply)?

- ❑ Home Energy Raters
- ❑ Utilities
- ❑ Weatherization professionals
- ❑ HVAC contractors
- ❑ Insulation contractors
- ❑ Energy Code calculation providers
- ❑ Builders will test their own homes
- ❑ Other, please describe: ____________________
- ❑ I don't know

If blower door testing is required in the FUTURE, do you or your company intend to conduct or offer blower door testing services?

- ❍ Yes
- ❍ No

Answer If If blower door testing is required in the future, do you or your company intend to conduct blower... Yes Is Selected

Have you or your company already acquired training to conduct blower door testing?

- ❍ Yes
- ❍ No

Answer If Have you or your company already acquired training to conduct blower door testing? Yes Is Selected

Which of the following best describes the type of training you received to conduct blower door testing?

- ❍ Self study
- ❍ Certification program
- ❍ Industry association training
- ❍ Other ____________________

Answer If If blower door testing is required in the future, do you or your company intend to conduct or offer blower door testing services? Yes Is Selected

If there were no changes in your current capacity and work load, estimate the number of additional blower door tests you could conduct annually within your normal service area. (Answer must be a single number e.g. 0, 25, 405)

Answer If If blower door testing is required in the future, do you or your company intend to conduct or offer blower door testing services? Yes Is Selected

What resources would you need to double the number of blower door tests annually (select all that apply)?
- ❑ Nothing
- ❑ Additional training
- ❑ Additional personnel
- ❑ Additional equipment
- ❑ Other ____________________
- ❑ I don't know

If whole-house mechanical ventilation is required in the FUTURE, will you or your company be involved in specifying such systems?
- ❍ Yes
- ❍ No

Answer If If whole-house mechanical ventilation is required in the future, will you or your company be involved in specifying such systems? Yes Is Selected

What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to comply with Florida Code requirements if/when the legislative delay ends (select all that apply)?
- ❑ Exhaust only (excluding occupant controlled kitchen and bathroom fans)
- ❑ HRV (heat recovery ventilator) or ERV (energy recovery ventilator)
- ❑ Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)
- ❑ Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)
- ❑ Other, please describe ____________________
- ❑ I don't know

Answer If What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co... Exhaust only Is Selected Or What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co... Supply only ventilation fan delivers outside air into the house (not via the main air handler fan) Is Selected Or What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co... Supply only: Runtime with control (ventilation air distributed via AC air handler with ventilation controller) Is Selected Or What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co... Balanced (supply and exhaust) without HRV or ERV Is Selected Or What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co... Balanced (supply and exhaust) with HRV or ERV Is Selected Or What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co... Unbalanced (supply and exhaust) without HRV or ERV Is Selected Or What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co... Unbalanced (supply and exhaust) with HRV or ERV Is Selected Or What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co... Other, please describe Is Selected And What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co... I don't know Is Not Selected And If whole-house mechanical ventilation is required in the future, will you or your company be invo... Yes Is Selected

Why would you specify this/these types?

Answer If If whole-house mechanical ventilation is required in the future, will you or your company be involved in specifying such systems? If no survey skips to next question. Yes Is Selected

Are there any types of whole-house mechanical ventilation system you would not specify to comply with the Florida Code requirement?

- ❍ Yes, please describe which system(s) you would not specify and why:____________________
- ❍ No
- ❍ I don't know

Answer If If whole-house mechanical ventilation is required in the future, will you or your company be involved in specifying such systems? Yes Is Selected

Considering your current capacity and work load, estimate the number of additional whole-house mechanical ventilation systems you could install annually (assuming one system per house) within your normal service area. (Answer must be a single number e.g. 0, 25, 405)

Answer If Approximately how many blower door tests have you conducted or had conducted for new Florida home... Text Response Is Greater Than 0 Or Approximately how many whole-house mechanical ventilation systems have you installed or had insta... Text Response Is Greater Than 0

Part 4 - Overall Experience with Blower Door Testing and Whole House Mechanical Ventilation

In Parts 2 and 3 we asked you about an example house and future plans respectively. Now, in Part 4, we'd like to ask about your EXPERIENCE OVER THE PAST TWO YEARS with blower door testing and whole-house mechanical ventilation systems, again in new residential code (three stories or less) construction.

Answer If Approximately how many blower door tests have you conducted or had conducted for homes you built or worked over the last two years in new Florida homes? (Answer must be a single number e.g. 0,... Enter an approximate number (Answer must be a single number e.g. 0, 25, 405): Is Greater Than 0

Please complete the table below for the blower door tests you have conducted or had conducted for new Florida homes over the PAST TWO YEARS. (Answer must be a single number e.g. 0, 25, 405):

**Note: If the blower door test was part of a larger scope of work, please estimate what it would have cost the builder to have only a blower door test and the associated reporting.*

	% of Total Blower Door Tests Conducted (%)	Approximate Average ACH50?	Approximate Average Cost to Builder for Blower Door Testing* ($)
Tested for ENERGY STAR or other program certification			
Tested for optional Florida Energy Code (performance path credit or envelope tightness demonstration)			
All others			

Answer If Approximately how many blower door tests have you conducted or had conducted for homes you built or worked over the last two years in new Florida homes? Approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

Based on past experience, what would you expect the ACH50 to be in a CODE-MINIMUM new Florida home (three stories or less)?
- ❍ ACH50 < 3
- ❍ ACH50 between 3.1 and 6
- ❍ ACH50 between 6.1 and 9
- ❍ ACH50 > 9
- ❍ I don't know
- ❍ Comments ____________________

Answer If Approximately how many blower door tests have you conducted or had conducted for homes you built or worked over the last two years in new Florida homes? Enter an approximate number (Answer must be a single number e.g. 0, 25, 405): Is Greater Than 0

In the PAST TWO YEARS, have you ever had a building delay of three or more days due to unavailability of house tightness testing personnel?
- ❍ Yes
- ❍ No

Answer If Have you ever had a building delay greater than three days due to an unavailable house tightness... Yes Is Selected

What percent (%) of time were delays of three or more days experienced? (Answer must be a single number e.g. 0, 25, 405)

Answer If Have you ever had a building delay greater than three days due to an unavailable house tightness... Yes Is Selected

What cost ($), if any, do you associate with a delay of three days in getting a test completed? (Answer must be a single number e.g. 0, 25, 405)

Answer If Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes?
Approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems you have installed in new Florida homes over the PAST TWO YEARS and estimate the average cost for each type (Answers must be a single number e.g. 0, 25, 405)

	% of Total Installs (%)	Approx. Average Cost to Builder Including Installation ($)
Exhaust only (excluding occupant controlled kitchen and bathroom fans)		
HRV (heat recovery ventilator) or ERV (energy recovery ventilator)		
Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)		
Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)		
Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)		
Other, please describe:		

Answer If Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes? Approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

In the PAST TWO YEARS, have you ever had a building delay of three days or more related to whole house mechanical ventilation installation?

- Yes
- No

Answer If Have you ever had a building delay greater than three days related to mechanical ventilation inst... Yes Is Selected And Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes? Approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

What percent (%) of time were delays of three or more days experienced?

Answer If Have you ever had a building delay greater than three days related to whole house mechanical ventilation installation? If no, survey skips to the next question. Yes Is Selected And Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes? Approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

What cost ($), if any, do you associate with a delay of three days in mechanical ventilation installation?

Answer If Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes? Approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

Why were the whole-house mechanical ventilation systems installed (select all that apply)?

- ❑ ENERGY STAR or other program requires it
- ❑ Builder standard practice
- ❑ Homeowner/buyer request
- ❑ Other, please describe ____________________

Answer If Approximately how many blower door tests have you conducted or had conducted for homes you built... Enter an approximate number (Answer must be a single number e.g. 0, 25, 405): Is Greater Than 0 Or Approximately how many whole-house mechanical ventilation systems have you installed or had insta... Enter an approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

Part 5 - Most Recent Blower Door Testing or Whole House Mechanical Ventilation Experiences

In Part 4, we asked about experience over the PAST TWO YEARS; now we'd like to ask about YOUR MOST RECENT EXPERIENCE, even if it is not a typical job, with blower door testing and whole-house mechanical ventilation systems, again in new residential code (three stories or less) construction.

Answer If Approximately how many blower door tests have you conducted or had conducted for homes you built or worked over the last two years in new Florida homes? Approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

Considering only YOUR MOST RECENT blower door test in a new Florida home (three stories or less), even if it was not typical of your work, please provide the following. (Answer must be a single number e.g. 0, 25, 405) Note: If the blower door test was part of a larger scope of work, please estimate what it would have cost the builder to have only a blower door test and the associated reporting.

	Month (MM)	Year (YYYY)	Approximate conditioned Area (ft2)	Number of bedrooms	Approximate ACH50 test result	Approximate cost to builder ($)
Most Recent Blower Door Test (Answer must be a single number e.g. 0, 25, 405)						

Answer If Approximately how many blower door tests have you conducted or had conducted for homes you built or worked over the last two years in new Florida homes? Enter an approximate number (Answer must be a single number e.g. 0, 25, 405): Is Greater Than 0

Why was YOUR MOST RECENT blower door test conducted (select all that apply)?

- ❑ ENERGY STAR or other program compliance
- ❑ Florida Code compliance (testing completed for air leakage reduction performance path code credit or for envelope tightness demonstration)
- ❑ Homeowner/buyer request
- ❑ Builder or contractor standard practice
- ❑ Other, please describe ____________________

Answer If Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes? Enter an approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

Considering only YOUR MOST RECENT whole-house mechanical ventilation system installation in a new Florida home (three stories or less), even if it was not typical of your work, please provide the following. (Answer must be a single number e.g. 0, 25, 405)

Note: If the whole-house mechanical ventilation system was part of a larger scope of work, please estimate the cost to the builder for only the whole-house mechanical ventilation system.

	Month (MM)	Year (YYYY)	Approximate conditioned area	Number of bedrooms	Approximate outside air flow (cfm)	Approximate cost to builder ($)
Most Recent Whole-House Mechanical Ventilation System Install (Answer must be a single number e.g. 0, 25, 405)						

Answer If Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes? Enter an approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

What type of system was YOUR MOST RECENT whole-house mechanical ventilation system?

- ❍ Exhaust only (excluding occupant controlled kitchen and bathroom fans)
- ❍ HRV (heat recovery ventilator) or ERV (energy recovery ventilator)
- ❍ Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)
- ❍ Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)
- ❍ Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)
- ❍ Other, please describe: ____________________

Answer If Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes? Approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

Why was YOUR MOST RECENT whole-house mechanical ventilation system included in this home (select all that apply)?
- ❑ ENERGY STAR or other program requires it
- ❑ Builder's request
- ❑ HVAC contractor or engineer's recommendation
- ❑ Homeowner/buyer's request
- ❑ Other ____________________

Answer If Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes? Approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

Why was this specific whole-house mechanical ventilation system selected (select all that apply)?
- ❑ HVAC contractor's choice
- ❑ Builder's choice
- ❑ Homeowner/buyer's choice
- ❑ Price
- ❑ Other, please describe: ____________________

Answer If Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the last two years in new Florida homes? Enter an approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

Was there any other additional HVAC cost ($) to the builder resulting from whole-house mechanical ventilation?
- ❍ No
- ❍ Yes

Answer If Was there any other additional HVAC cost to the builder resulting from whole-house mechanical ven... Yes Is Selected And Approximately how many whole-house mechanical ventilation systems have you installed or had insta... Enter an approximate number (Answer must be a single number e.g. 0, 25, 405) Is Greater Than 0

If there was additional HVAC cost to the builder resulting from whole-house mechanical ventilation, please estimate the cost and describe the expense.
- ❑ Estimate cost ($) (Answer must be a single number e.g. 0, 25, 405) ____________________
- ❑ Describe the expense ____________________

Answer If Approximately how many whole-house mechanical ventilation systems have you installed or had insta... Text Response Is Greater Than 0

Any additional information or comments on YOUR MOST RECENT whole-house mechanical ventilation system?

Part 6 – General

Do you anticipate that the Florida Code's blower door testing requirement and the associated whole-house air tightness requirement will be beneficial overall?

- ❍ Yes
- ❍ No

Additional blower door test related comments:

Do you anticipate that the Florida Code's whole-house mechanical ventilation requirement will be beneficial overall?

- ❍ Yes
- ❍ No

Additional whole-house mechanical ventilation related comments:

Appendix E:
Residential Construction Survey Summary Report

My Report

Last Modified: 11/23/2015

1. Part 1 - About Your Business Have you been involved in the construction of new Florida homes over the PAST TWO YEARS?

#	Answer	Bar	Response	%
1	Yes		661	79%
2	No		171	21%
	Total		832	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.21
Variance	0.16
Standard Deviation	0.40
Total Responses	832

2. Please list the Florida counties you serve (select all that apply):

#	Answer	Bar	Response	%
1	Alachua		39	7%
2	Baker		21	4%
3	Bay		30	5%
4	Bradford		16	3%
5	Brevard		45	8%
6	Broward		109	20%
7	Calhoun		12	2%
8	Charlotte		49	9%
9	Hernando		51	9%
10	Highlands		18	3%
11	Hillsborough		104	19%
12	Holmes		18	3%
13	Indian River		42	8%
14	Jackson		15	3%
15	Citrus		39	7%
16	Clay		46	8%
17	Collier		69	12%
18	Columbia		22	4%
19	DeSota		18	3%
20	Dixie		17	3%
21	Duval		69	12%
22	Escambia		40	7%
23	Flagler		40	7%
24	Franklin		12	2%
25	Gadsden		12	2%
26	Gilchrist		16	3%
27	Glades		11	2%
28	Gulf		15	3%
29	Hamilton		11	2%
30	Hardee		14	3%
31	Hendry		21	4%
32	Jefferson		14	3%
33	Lafayette		12	2%
34	Lake		54	10%
35	Lee		72	13%
36	Leon		20	4%
37	Levy		19	3%
38	Liberty		10	2%
40	Madison		14	3%
41	Manatee		68	12%
42	Marion		40	7%
43	Martin		63	11%
44	Miami-Dade		93	17%
45	Monroe		27	5%
46	Nassau		35	6%
47	Okaloosa		35	6%
48	Okeechobee		23	4%
49	Orange		91	16%
50	Osceola		61	11%
51	Palm Beach		118	21%
52	Pasco		79	14%
53	Pinellas		83	15%

54	Polk		74	13%
55	Putnam		24	4%
56	Santa Rosa		47	8%
57	Sarasota		76	14%
58	Seminole		64	11%
59	St. Johns		72	13%
60	St. Lucie		58	10%
61	Sumter		29	5%
62	Suwannee		17	3%
63	Taylor		11	2%
64	Union		10	2%
65	Volusia		61	11%
66	Wakulla		13	2%
67	Walton		44	8%
68	Washington		19	3%

Statistic	Value
Min Value	1
Max Value	68
Total Responses	557

3. Are you a (an) (select all that apply):

#	Answer	Bar	Response	%
1	Home Builder		272	40%
2	HVAC Contractor		196	29%
3	Trade Contractor Other than HVAC, please describe:		54	8%
4	Certified Home Energy Rater		93	14%
5	Weatherization Industry Professional		20	3%
6	Other Blower Door Testing Provider		22	3%
7	Mechanical Engineer		38	6%
8	Code Official		37	5%
9	Other, please describe		130	19%

Trade Contractor Other than HVAC, please describe:	Other, please describe
	Engineer, Building Scientist
	Architect
	General contractor
	residential construction manager, cgc1516843
	General Contractor
	research in NGO
	Architect and Florida Certified home Inspector
	Instructor
	Architect/Engineering Firm
	General contractor
	Architect
	Certified General Contractor Specializing in renovation and remodeling
	General Contractor
Marine Specialty	General Contractor Marine Specialty Contractor Home Inspector Mold Assessor Mold Remediator Commercial Building Inspector Residential Building Inspector Commercial Plumbing Inspector Residential Plumbing Inspector Coastal Constructoion Inspector
	Professional Engineer
	Utility Employee doing energy efficient building program
	Home Designer
	consultant
	Building Enclosure Consultant/Engineer
	Architect
	Consulting Engineer
	General Contractor
	Commercial contractor
	Homebuilder with a certified general contractor license. A BPI QCI certified inspector. An advisor to most of Florida for the WAP program including fielding calls from state and DOE representative.
	general contractor
	Certified General contractor
	mostly commercial last two years
I am a HVAC contractor but most importanly I am a HVAC commissioning authorty	Commissioning agent and mechanical contractor
	Structural engineer
	General Contractor
	p e
	CGC I primarily engage in concrete work.
	Design Engineer
	Building Diagnostician Certified Thermographer Building's Research (energy/moisture)
	general contractor
	Certified General Contractor Buildings
	general contractor, I do doors, windows ,Bathroom and Kitchen remodels
	HVAC Designer

	Architect
	General Contractor doing Assisted living & other multi family facilities
Utility	Energy Efficiency Inspector, Energy Advisor
Test and Balance	As the codes have not required test and balance for residential, until now, we have not been too involved.
	Certified General Contractor
	LEED/FGBC/NGBS third-party green home verifier
	Architect, General Contractor
	GC, we do both residential and commercial work.
	Florida State Certified General Contractor
	Architect
	General Contractor
	Architect
	Research
	Architect
	General Contractor
	Ac contractor
	Architect
	Consultant - Business Owner
	Architect
	Architect
	GC
	Architect
	residential contractor building additions
	Architect
	Property Insurer
	Engineer
	structural engineer
	ARCHITECT
	ARCHITECT
	Architect
	Utility-Energy Services-was a rater-but certification expired and have not renewed as of yet.
	Realtor, and home investor and remodeler.
	Marketing/Key Account Representative with Choctawhatchee Electric Cooperative, a distribution electric cooperative.
	Architect
	Architect
	Architect
	General Contractor
	Utility Employee.
	Building materials supplier
	Home remolder
	Architect
	Architect
	Architect
	Architect
	Architect
	Architectural and Engineering Firm
	architect
	Architect
	Architect
	Architect
CGC & CCC	General & Roofing
	Residential Designer
	Architect
	CGC
	Architect

	Architect . I work for G.L. Homes
	Architect
	architect/engineer
	Architect
	Registered Architect
	Researcher & Educator
	architect

This table has more than 100 rows. Click here to view all responses

Statistic	Value
Min Value	1
Max Value	9
Total Responses	677

4. Approximately how many blower door tests have you conducted or had conducted for new Florida homes you built or worked on over the PAST TWO YEARS? (Answer must be a single number e.g. 0, 25, 405):

Text Response
0
6
0
500
4
0
0
0
0
0
0
0
2
500
6
0
1
5
0
0
150
0
0
0
4
0
0
92
50
0
0
73
0
20
0
0
0
460
0
0
0
0
0
0
0
50
0
0
0
0

0
0
0
0
0
0
0
1
0
0
0
0
2
0
0
0
00
0
75
0
0
0
0
0
0
1
0
12
0
0
1
0
200
0
0
0
5
897
0
12
0
8
0
6
50
6
20
0
0
0

This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	683

5. Approximately how many whole-house mechanical ventilation systems have you installed or had installed over the PAST TWO YEARS in new Florida homes? (Answer must be a single number e.g. 0, 25, 405)

Text Response
25
22
0
20
1
0
0
3
0
0
5
0
2
350
6
2
10
1
1
0
150
0
8
3
1
0
0
235
0
0
0
4
0
150
0
0
6
403
0
0
0
0
0
0
0
0
7000
45
0
0

0
15
0
30
1
10
0
0
0
200
0
1
2
4
0
12
0
0
50
200
0
0
0
3
0
0
0
0
0
8
30
0
25
0
8
15
10
897
0
60
0
50
10
6
5
44
20
35
0
0
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	683

6. AIR SEALING Estimate the cost ($) to the builder for typical air sealing measures for the EXAMPLE HOUSE built to the Florida Code’s MINIMUM REQUIREMENTS. (See Table R402.4.1.1 Air Barrier And Insulation Installation of the Florida Building Code, Energy Conservation, Chapter 4, full text). (Answer must be a single number e.g. 0, 25, 405)

Text Response
14000
800
800
0
0
1000
0
2000.00
165.00
1500
750
2500
600
2100
100
0
200
0
1000
1500
500
2,000.00
895
0
400
200
1500
250
500
557
5
1500
500
2000
475
1800
1800
200
1750
0
5000
1250
2,000
45
405
1200
500.00
600
5000

0
450
500
500
700
25000
0
5000
2500
1000
600.00
1,000
1600
1,000
0
2500
400
2500
500
0
500
500.
1200
2800
200
2500
2,000.00
0
450
200
0
200
1000
150
2,000
260
750
5000
2500
300
3000
1200
200
1100
2500
5000
2000
0
1500
3000
1600
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	351

7. Would any additional air sealing be necessary to reach the required blower door test result of no greater than 5 ACH50.

#	Answer	Bar	Response	%
1	Yes, in many or all cases.		171	35%
2	No, unlikely for most homes		154	32%
3	I don't know		157	33%
	Total		482	

Statistic	Value
Min Value	1
Max Value	3
Mean	1.97
Variance	0.68
Standard Deviation	0.83
Total Responses	482

8. If yes, please estimate the additional cost ($). (Answer must be a single number e.g. 0, 25, 405)

Text Response
2000
1000
1000
250
2500
1500
0
1500
3000
1000
500
200
2500
1,500
500
697
2000
250
1500
800
500
405
7000
3000
1500
500
600.00
200
1000
1500
700
2,500.00
450
1000
1,000
500
1000
1200
600
250
15
500
250
250
1000
3200
1000
350
800
600
4

200
123456789
2000
150
500
200
300
500
1500
500
5
2500
500
1000
125
600
750
750
100
300
250
2000
1200
250
0
400.00
100
405
1000
5000
1000
500
250
150
1500
1000
1500
500
1,800
250
499
200
1000.00
2000
500
100
500
500
2000
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	127

9. Please describe the additional air sealing necessary to reach the required blower door test result of no great than 5 ACH50.

Text Response
Unknown
WRB and/or Air Barrier product upgrade, additional labor to properly install same. Additional labor and materials to better seal exterior walls to slab and walls to ceiling-level finishes. Additional labor and materials to better seal interior walls to ceiling-level finishes. Improved ceiling board-to-electrical connections detailing and installation characteristics. Additional labor and material to improve sealing around/behind cabinets, tubs and plumbing accessories. Relocation of HVAC equipment. Others, as applicable.
Because of the blower door test, it will reveal cracks and crevices missed during the standard sealing. Those areas will require additional investigation time and money to find the cracks and plug them. Sealing a building too tight and then having to use energy to cool and dehumidify outdoor air for ventilation is counter productive and an unnecessary use of energy. The minor cracks and crevices missed during construction will let in the necessary fresh air to the interior.
Re-seal all ducts, HVAC in closet re-seal closet, top plate on walls, add more insulation correctly, seal around all conditioned io unconditioned penetrations and better windows and sliding door requirements.
Unknown, Every house is different. The additional testing slows the project, adds cost, with no practical benefit to the builder or homeowner.
Additional air sealing measures usually include verifying that leaks into or from wall cavities have an effective air barrier, sealing return plenums and gaps between drywall and supply grills.
Sliding glass doors will prevent the structure from achieving 5 ACH50, and will need to be replaced by hinged swinging doors
you will need to install a drywall ceiling only. which means the insulation contractor will have to charge additional time because he cannot compete his job in one trip like before. you will lose a day waiting for the partial insulation inspection before you can drywall. the drywall contractor will have to charge more because he will have to install the ceiling only and the drywall finisher will have to flat tape all the drywall where It meets the top plates in order to get a good seal for the blower door test the area where it got flat taped will have to be retaped when the walls are finally installed
Double perimeter inner tyvek triple tape seals and double ship lap connections with fasteners
sealing electrical components, plumbing and ventilation wall/roof penetrations
Drywall penitrations, outlets, switches, register boxes, door jambs leak due to drywall not being sealed to the top plate. It would not be cost effective to seal. The benifits of a house that tight dont outway the cost to seal it.
Mastic and tape on most seams
Having to seal around boots on after sheetrock has been hung. Sealing air handler better then they are from manufacture. (They all leak, and none would pass straight out of the box)
If you make a house to tight you are going to have problems. And the added costs for these stupid tests are only going to make the testing companies money while taking money from the people that can barely afford to build a house. Total up all of the cost just to start building a house, ridiculous.
Sealing of the attic sheathing and roof penetrations from below
The attic would have to be sealed completely and fresh air mechanically introduced into the structure.
Sealing all the wholes created by each trade with foam, paying extra to the plumbers, electricians and insulated to do this on each of their part. Insulating the heat trap of the water heater, providing enough mastic and tape to keep from leakage, adding step up trusses to allow for enough insulation closest to the eaves, making sure that each attic knee wall has 6 sided construction means paying more for the framing to be done properly, the delay in time to do all of this.
Sealing attic and soffit with open or closed cell foam
would have to allow for time to reseal or recheck
Additional parts and labor for all items penetrating the barrier seperating the attic and living spaces. Component changes for bath fans, dryer vents, range vents and etc to include tight backdraft dampers.
Spray Foam Insulation
Plate sealing. Prescriptive framing. Drywall butt joint and penetration sealing.
IF EXISTING CONSTRUCTION: SEALING WINDOWS-DOORS-TOP PLATES-GASKETS BEHIND COVER PLATES FOR DEVICES-ATTIC ACCESS SEAL IF NEW CONSTRUCTION-LESS COST-LESS LABOR-TOP & BOTTOM PLATE SEALS-SEALING WINDOWS-BETTER ATTIC ACCESS SEAL
Ceiling penetrations, ductwork
Duct drop penetrations, all penetrations from unconditioned to condition space have to be re-sealed in most cases.
More attention to insulation details, callbacks if blower door test results in leakage greater than 5 ACH50.
seal around all outlet plates and switch plates, seal around all A/C vents, Seal all attic access covers, seal drywall to framing top plate, seal around light fixtures and can lights.
If the home is built to code from the very start there shouldn't have to be any additional air sealing necessary. However, with that being said, most homes are not built to the FBC.
All vents and duct work would have to be improved. All wall penetrations would have to be sealed better.
This is very much a mystery, but could involve all sorts of areas.
Light fixtures, additional caulking and labor from painting, stucco, siding and house wrap contractors
In non-foam attic insulated home, all penetrations through drywall (eg hvac supply/return vents, lights, fans, etc) will need to be caulked to ceilings which must be done after drywall installation. This is expensive based on how much extra electric people are requiring these days. Also, the blower door test will slow construction considerably since you will need to to seal everything up, then you will have to wait on the rater (people are busy are never available the day you need them), then the house will need to be cleared for the rater, and then you will need to wait on the report to get a final inspection.
We have been using open cell foam and having extra sealing measures for many years but realize that is over the minimum required by code. Foam sealing around the windows and doors, foam pads under the exterior doors, open cell foam in the attic. We have a thermal by pass exam performed to determine if any spots are missed. These are not by code but are additional costs up front.
Caulking HVAC registers to drywall. Using mastic to seal all of the HVAC duct joints.
Can lights would have to be sealed and any other wall/and or ceiling fixture that is not stereotypically caulked in-place
do not know as it is not required here
actually building it to code and following manufacturer's specs
Why would you have a code official take this survey?

It is unknown at the moment at what point a house will be tight enough to pass this test. If a house can be tight enough prior to sheetrock, then the cost of the test would be a burden as well as additional sealing. If you need sheetrock up to pass and you don't, then it is incredibly hard to find your leak and therefore would become costly into the thousands to purchase and rehand sheetrock

All electrical outlets and lights, hvac

Additional labor and time to seal various leaks i.e. vents outlets etc.

Plumbing & electric box/panel penetrations, repair weather door/window stripping gaps, seal attic access hatch. Caulk seal trim, baseboards. These would not need to be done after air sealing, if they were done properly as normal best practices by the trades. This is normal punch-out work in quality construction. Pay extra at the end of the job to meet code for one home only as a learning experience. This should not be repeated if and when a quality air barrier inspection is routine, and not just signed off without compliance. Does the builder who routinely fails READ the EPL cards? I would like the signers of the EPL cards take a quiz on what he has signed. These builders don't read it and don't care. It is not a cost issue it is proper installation issues, quality assurance that builders are resisting. These builders need to add "Caveat Emptor" to their new home sales contracts and not make false claims on their building permits.

Additional weatherstripoing, door seals and rebuild door jamb

Foaming and caulking

Depends on doors, windows, and insulation selected and installation techniques.

many different task were done

Ceiling/attic penetrations

Unknown but any new code always has additional costs

Sealing of all framing members, sealing of all jumper ducts and wall assembly whichin it lies, sealing of all outlets and wall penetrations.

More perimeter caulking/sealing

All entrances exterior and adjacent rooms,sliding glass doors,windows.

Mastic interior of flex duct before sliding on collar, mastic collar into box, fab and mastic vapor barrier to box

windows, doors electrical outlets and light fixtures interior.

mastic of all connections in duc ts and grille boxes and return s

Bath and kitchen venting will need to be sealed better.

Option does not give me the opportunity to put I do not know

Gaskets @all penetrations

Seal bottom plates, seal around AC supply & registers with chaulk after drywall, seal around all ceiling outlet boxes, seal all plumbing, electrical, low voltage drill holes in top plates.

inner/outer rings/collars each opening with sealant between each termination.

Seal Supply Air and Return Air Boot Boxes to drywall surface

seal around door

Sill, Plate, Door, Window, Eave, etc.

mecanical sealing with tapes and paints to complete sealing of ducting

seal around recess lights, attic access panels, A/C vent grills

AHU Closet must be sealed 100%. MO's and RO's must be sealed from the inside. Thresholds must be sealed.

100 percent positive sealing backdraft dampers for exhaust fans 200 to 300 per fan plus access doors for motors

recepticles, exhaust fans,

the window and door bucks to window frames would need sealing. any thru the wall pipes would need to be sealed. The attic access would need to be sealed. The a/c ducts thru the ceilings would need to be sealed.

Better windows, better doorsand better wall construction.

window door perimeters attic and exterior wall penetrations

sealing of lights, windows, doors,

MASTIC,TAPE,SHEETMETAL,TESTING PREP,UN DUE TESTING PREP,AND A NON UNIFORM BUILDING CODE THAT VARIES THROUGH OUT THE STATE,COUNTY TO COUNTY,AND CITY TO CITY.

3rd party duct sealing, proactive testing. Quality installation alone is not enough.

sealing around all light fixture, return, supply, and penetrations in the ceilings

Seal canned lights, seal hvac boots, better seal attic access, add a bead of calk along with the sill seal under the bottom plate; as well as, a bead of calk along the top plate.

Based on residential projects I've done in other states to meet LEED Gold and HERS score of 70 or less, which roughly equates to 5AC50, the amount of sealing is significant compared to typical residential construction. Electrical outlet boxes, wall/floor joints & intersections, interior wall intersections at outside walls, rim joists, roof penetrations and wall penetrations all must be thoroughly addressed. In some cases, we've had to revise industry standard details, such as roof penetrations, because sealing around the annular space alone isn't enough.

Exterior walls - become ICF Attic - No soffit vents, closed cell 2 part foam insulation underside of sheathing and over soffits, this requires conditioning attic space (increase in ducting and unit size) Ventilation - Assume humid area in Fl, Requires ERV and dehumidifier to cope with added air change.

Many homes are not meeting the code, and the additional cost is what they will have to spend to do the job correctly.

Going to leak free ducts and the material / labor of HVAC subcontractors to seal the ducts with mastic. Also the cost of the leak free duct test as well as the blower door test.

Detail sealing and caluking at all drywall penetrations

Some locations of AC units, i.e. attic, make it more difficult to seal. Code compliance allows some units to go in the garage. Also, and unfinished door may not be sealed properly. Some are not sealing around grilles. One instance was where the front door wasn't properly installed and it showed on the blower door test.

Sealing around all light fixtures and cans, sealing around all A/C vents and returns, sealing drywall to framing top plate, sealing all attic access panels

Greater care would be needed on the duct collar with mastic on both sides of the flange. Register boxes would have to have all seams sealed with mastic. Air handler would have to have cork tape at drain and refrigeration line penetrations and wiring penetrations. All panel seams taped. Mfg oil residue on duct collars would have to be cleaned off

for inner liner to secure 100%
Typically, foaming around outlets, lights and a/c grills. Anywhere there are drywall penetrations.
the inspectors in this area do not inspect insulation so the insulation is not properly installed. and for it to be properly installed the installers charge extra to do that.
depends on the swing of the door, and locking mechanism, A one point lock system, full light that swings out would let a lot more air past, than an in swing doors, you need to use windows they would have no flex To them. you will get different reading from and in swing or and out swing. and 1 point lock vs. 3 point lock, also different air flow from a full light vs. solid door. your not testing apples with apples.
Caulking / Sealing of exterior bottom plates and all top plates. Sealing of gaps in stud stacks and gaps between bottom plates and sheathing.
penatrations thru drywall recepticles
Duct, doors, vents, fans
significant duct sealing...drywall sealing...better dampers on exhaust fans, dryer vents & range hoods
Recessed lighting Where walls meet ceiling Window frames

Statistic	Value
Total Responses	92

10. BLOWER DOOR TESTINGEstimate the cost to builder for conducting a blower door test and all associated reporting and communications for the EXAMPLE HOUSE assuming it is within the tester's normal service area.

Default - For the EXAMPLE HOUSE (Answer must be a single number e.g. 0, 25, 405)			
Estimated cost to builder for testing, associated reporting, and all communications ($)	**On-site time needed to conduct test (hours)**	**How long, if at all, would normal site activity need to stop for testing (hours)**	**Fee for retesting, if necessary ($)**
2000	2	24	500
675	68		475
400	4	4	250
800	2	1	600
1000	5	740	
500.00	2	8	500.00
300.00	2	3	500
1500	3	0	240
600	4	4	400
695	2	4	395
600	2	2	600
3000	4	16	4000
125	1	1	125
250	2	0	120
300	6	8	200
250	1	.5	75
0	0	0	0
300	2	2	150
300	2	1	150
1000	8	8	1000
1500	4		
500	48	48	200
250	1	1	125
650	3	1	150
300	2	1	150
400	2	3	400
500	48	48	500
150	1	1	75
200	2	2	200
499	2.7	3.0	399
300	3	4	500
1500	8	8	1500
79	0	2	79
500	2	2	300
275	1	1	
1500	4	8	500
500	12	0	300
500	2	2	250
450	6	8	200
300	1	.5	100
5000	10	48	5000
750	4	2	300
995	48	4	450
50	2	2	25
405	405	405	405
400	2	1	0
1000.00	5	5	250
700	4	4	500
500	3	5	500

0	0	0	0
350	1	1	150
350	3	3	150
250	1	1	250
200	1	1	0
1500	8	8	0
350	4	1	300
350	5	3	350
750	4	4	750
95	1	0	95
350	2	2	150
500	2	2	300
600.00	5	4	450.00
125.00	1	1	75.00
500	3	4	400
2500	5	24	800
500	3	3	150
1800	6	6	1200
400	2	3	250
350	4	2	350
650	3	3	450
200	1	1	200
350	1	1	150
850.	3	3	0
200	1.5	1	150
400	4	16	250
175	1.5	.5	175
1200	4	1	1200
250.00	2	2	250.00
350	5	6	75
450	2	1	250
150	1	.25	50
100	1	0	75
300	1	1	300
250	1.5	0	100
200	1	1	100
149	.5	.17	149
350	1	1	150
190	0.5	0.5	160
300	2	.25	150
750	1	0	0
600	4	4	200
300	2	2	300
300	.5	0	100
5000	10	24	
500	5	4	300
300	2	2	150
250	2	3	250
300	4	1	300
400	4	1.5	200
1500	6	6	1000

This table has more than 100 rows. Click here to view all responses

Statistic	For the EXAMPLE HOUSE (Answer must be a single number e.g. 0, 25, 405)
Min Value	-

Max Value	-
Total Responses	-

11. Are there any factors that would warrant a substantial increase or decrease in your cost estimate for the EXAMPLE HOUSE?

#	Answer	Bar	Response	%
1	Increase		171	94%
2	Decrease		70	39%

Increase	Decrease
Retest. Code understanding. Inspection results acceptable to county. Stopping construction. Redoing work.	
How many windows. doors penetrations ?	
Large Kitchen Hoods and/or multiple fireplaces	
Time, material, testing, correcting, re-testing, loss of time in schedule	
If numerous leaks detected and then time waiting for them to get plugged and then retesting to see if it worked; if testing finds that builder did not seal the ducts or lights and tester has to wait around for that to get done before performing the test	If the builder has done his own blower door test prior to the certified tester doing the real test and finds that everything has been tightly sealed.
Time needed to get the official test result.	
multiple air handlers	multiple houses to be tested in same area
Poor HVAC installation	Past history of other homes by builder
lack of involvement, hard to get into homes, no A/C contractor involvement, homes far apart, homes over 2,000' living, detached or 2-story homes and having to go back to retest.	Utility rebates if available, homes close together, signed contract from builder, A/C contractor relationship.
Retesting due to failure of seals, additional costs to the contractor to bring a new crew to the job site	
Multiple HVAC systems, remote location,	Builder familiar with air sealing and testing
drywall , insulation ,Extra time for the testing and extra time for the partial inspection (drywall screw, insulation)	
Builder does not communicate schedule accurately, causing repeat visits to job site.	Builder is always ready on time with work done correctly.
Added time for adjument modifiers and simple reporting requirements	
This $79 dollars is the price to get my house blower door tested in my part of Florida by an independent contractor.	
Remaining on the job while house is repaired to get it to pass.	
time	
County required inspection would substantially increase cost	
Scheduling requirement, after hours work, turn around time on paperwork	
More time to install, return to make corrections and more materials to complete job	
Time	Do away altogether with this blower door requirement and let the market place demand the service, or have the utility industry fund is own energy saving programs with dollar for dollar rebates.
Who wrote these questions? Of course there would be an increase, whether it's substantial depends on the cost of the house.	
The only price increase I would have to charge for would be if the house was so large that it would require a second blower door to depressurize the house or if the homeowner/builder wanted thermal images of the home taken durning testing.	My prices usually stay the same. I don't t tend to go lower because the time it takes to test a 1500sqft house and a 2000sqft varries little in time. The majority of my associated cost come from reporting to RESNET, licensing fees, computer program cost and the Insurance policy that RESNET demands I have in order to test the house.
Blower door test, someone on-site to correct any sealing deficiencies.	
Improved indoor air quality and reduced energy cost	
Poorly sealed that would require several re-tests.	Passed the first time.
If the home is larger then you have to charge more, if you make any pre-dry wall visits, this will increase the cost. Which should be done to insure that the blower door will test correctly	If the home has a foam attic the likelihood that it will not make 5 is slim. This would also insure for a faster in and out since you won't have to isolate the duct system. Or if the home has all ductless units.
Very isolated location	High volume in one location
Envelope not ready	
none	none
Additional time to conduct the testing. The cost of the testing. Additional measures if the test fails. Fresh air intake ventilation.	
3500	
multiple stories or larger home with multiple systems	smaller house
Additional labor to man the project will the blower test is being completed by the 3rd party. Correcting items that are damaged during the construction process.	No savings
multi story, more openings such as bath fans etc.	
Power and start up prior to CO. Delay move in. Don't see economic return, particularly fro affordable housing.	
Stilt home, fireplace(s)	

Complexity of home. Access to mechanical systems that need to be shut down and sealed for the test.	Building preparation is completed by the general contractor prior to the testing agency arrival to site. Testing agency would only be responsible for conducting the test.
MORE GOVERNMENT REGULATION	EASE OFF ON THE LESS THAN 5 AIR EXCHANGES FOR MECHANICAL VENTILATION REQUIREMENT
these codes are getting out of control.....	
Distance away,	Close location
if correct energy measure were not employed by the builder	none
300	100
custom built home	production built home
Having to do the testing	
Sub standard builders incapable of reading writing the English language	
Retesting, problems getting into the home, lack of communication.	Builder knows what he or she is doing set several homes up in the same area to test, however I do not give discounts!
Accessibility, Design of doors, Ceiling height (20'+)	Simple design of doors, multiple tests for bulk discount, if several
Trying to find leakage in concealed spaces could take up to 8 hours and require smoke testing at an additional cost. Accessing areas for repairs could force removal and replacement of finish materials adding days of delay and costs of up to $1,000.	
poor test results	
Summer rains will impact the ability to conduct the test.	
extra testing, prep time involved, accessibility to property	house ready to test upon arrival
We required door and window wood bucks to be installed in full sealant bed. There must have been an additional cost for this but it was never itemized.	
if the house isn't test "ready"	if the builder has multiple homes ready for testing in the same neighborhood
High ceilings multiple return air ducts	
no	no
Trying to understand the intent of this question - is it "What factors would waarant the increase in cost?" If that is the question, then lots of factors will cause the costs to increase for this work. Worst part is that the costs must be passed on to the buyer, along with the builder's cost of money, real estate commissions, overhead and profit, etc, So, no matter what the cost is you need to add a mark-up of between 30 to 40% to arrive at the economic impact of this change.	
Sealing of penetrations to drywall, testing cost, time cost	
If the house is extremely leaky and the report involved a lot of description. If the house were fueled by gas, it would add additional cost due to making sure proper gas procedures were followed and calculating the CAZ for the home. If the house was not ready for inspection at the time it was scheduled.	Cost could be reduced IF the home was ready and there were more than one home in a given location. Volume discounts.
no	More competition if this is a required test and costs may go down a little.
2500	
size of home	
Code requirements that facilitate leaks and require the builder to correct in field during construction.	The more we test the more costs will go down over time.
second story inadequate opening for test equipment Combustion appliance present Duct testing	
325 We have construction loan costs of $150/day per house, so $75 was added to the cost of the test, because we will delay construction completion by 1/2 day.	
excessive travel, immediate service	
Missing attic hatch, multiple seprate caz zones as blower door testing inspector would want to verfiy caz zones are functioning properly. Dealing with building code inspector when tthey have no clue and either want to learn and slow us down or act like they know and red tag everything when no problem exist.	Volume in the area, vacant home with no workers, simple paperwork process.
Assuming the house is a spec, you have to assume the cost of the test itself, loss of labor on the house during testing, and the interest lost (at minimum) for the one day of testing. If the house does not pass, you would have to factor additional interest and expenses.	
builder's who are idiots/don't listen/don't care	
Additional time to test the project and additional reporting and repairs to effected areas if needed.	
Larger homes requiring multiple blowers	
800	
Retrsting	
none	none
No	Multiple homes in same area available on same day
Depends on the level of test required and what certifications you are trying to attain	Not having to re-test
if builder and trades were not trained in proper air sealing techniques then repeated failures would result in higher fees	
Having to provide assistance in guaranteeing home sealed and ready for test, no control of other trade activitie during testing	Multipe homes in same area, having builder assist in keeping site clear of trades during testing

Inability of the builder to make the house compliant.	Scale of economics-more to do equals less to charge.
improper scheduling	multiple units in same complex
Contractor did a poor job of constructing and detailing the house, or value engineered components out of the design.	
Better construction practices	
vaulted ceilings, high stairwells	8' ceilings and less rooms
job conditions	job conditions
Location of air handler	
Resistent people who fail to co-oridinate this work in a timely fashion and work schedule.	Helpful people who facilatate to co-oridinate this work in a timely fashion and work schedule.
Fireplaces	
Expansion of scope of required work , schedule , time and money	
It's too much to ask for	
No	No
Labor	
Construction components	construction components
size of house, travel	none
no	
Number of doors or windows above average.	
time associated	
no examples time and material base	na
I believe all this sealing is making sick homes. Need to go back 20 years in code to make everyone happy.	
additional contractor/scheduling etc	

This table has more than 100 rows. Click here to view all responses

Statistic	Value
Min Value	1
Max Value	2
Total Responses	181

12. Estimate when the builder could expect to receive the testing results:

#	Answer	Bar	Response	%
1	The same or next business day		120	34%
2	2 or 3 business days		106	30%
3	4 or 5 business days		48	14%
4	More than 5 business days		19	5%
5	I don't know		60	17%
	Total		353	

Statistic	Value
Min Value	1
Max Value	5
Mean	2.41
Variance	2.06
Standard Deviation	1.43
Total Responses	353

13. WHOLE HOUSE MECHANICAL VENTILATION SYSTEM What type of 2014 Florida Code compliant whole-house mechanical ventilation system would you specify for the EXAMPLE HOUSE (select one answer):

#	Answer	Bar	Response	%
1	Exhaust only (excluding occupant controlled kitchen and bathroom fans)		59	20%
2	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)		24	8%
3	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)		107	37%
4	HRV (heat recover ventilator) or ERV (energy recovery ventilator)		54	19%
8	Other, please describe		45	16%
	Total		289	

Other, please describe
You people are going straight for the same problem we have in commercial buildings " called sick building sydrome" If you make a house to tight and don't let it breathe you are CAUSING a problem. And should be sued accordingly for making us do so.
NONE
Whole house Dehumidifier
don't understand your question
When a building is built so tight that little air is turned over you run the chance of making a sick building. The air has to change, wither your bringing in fresh and pushing out the old or using an expensive air purification system like Lennox Pure Aire.
I would not specify. If so mandated it would be the simplest system with the lowest cost.
MAKE UP AIR TO THE EXHAUSTING APPLIANCE OR SYSTEM
The ventilation systems I use depend on what the builder wants to spend. For climate zone 2 ventilation only will cause humidity problems inside the home. So I will give the options of Supply only - Duct line pulling outside air into the rerun side of the AH Supply only - Using a dehumidifier to pull outside air (which works better than an ERV in the houses I have used them) The next options are based off of the last two but have temperature and humidity cut offs so the system will not pull outside air if it is too hot or humid and to add some form of timed intermittent exhaust. When I use a timer to bring exhaust on in a house I never exhaust more air than I am brining in. Also note that all fresh air intakes are dampered as not to pull outside air into when system isn't calling for it.
I wouldn't put more than this, you will end up running the a/c and costing the home owner more in utility costs.
Any outside air introduced should normally include dehumidification. For commercial buildings we like to include CO2 sensors to determine when outside air is really necessary. 5 air changes per hour seems like a lot considering ASHRAE was using 3.5
supply only with O.A into a whole house dehumidifier, then into the AC system with combination temp, humidity, ventilation control.
HRV and ERV are not a good solution for Central Florida's tropical climate. A mechanical whole-house dehumidified such as the Honeywell DR90 is the only proper way to bring in outside air. Cost to operate but removes risk of high humidity build up.
Fresh air supplied through a whole house dehumidifier to the a/c system with a ventilation controller
200
I am not familiar with the mechanical ventilation systems listed. My experience is limited to blower door testing for this survey.
MECHANICAL VENTILATION WITH OPERATION OF THE HVAC SYSTEM. CONDITIONED ONLY WITH ERV WHEN A HIGH DEMAND OF VENTILATION IS REQUIRED
Duct work inside the condition space. Air handler in the condition area. No unsealed fiberglass duct work. Good thermostat regulates system when no one home and zoned according to use.
No additional ventillation is needed. If you seal the home tighter as a result of trying to achieve 5 ACH50, then mechanical ventillation may be required and more humity and mold issues will arise when homeowners fail to maintain these systems!!!
Any system that connects with the outside
Location dependent base primarily on average dewpoint temperature- and type of construction
The way I am reading this code, coupled with best practices, there is only one very expensive answer - an HRV or ERV
dehumidifier
Cannot be determined with the information provided alone
Never exhaust as incoming moist air into building cavity equals mold. ERV is balanced but consumers want to know what's wrong if you use the cheaper Panasonic unit or other brands use lots of duct vents. In-take from the return air side using the Honeywell 8150 is ok but it follows the ashrae 62.2-2010 and not 2013. I would like to see a humidistat on exterior so at 55% it would turn system off or best of all use a Carrier Green speed so the a/c system becomes a dehumidifier and dry the home out. My ICF homes just need humidity lowered.
Whole House Ventilating Dehumidifier
Supply and balanced, Positive return each living space.
Fresh air duct with damper and humidty control at stat.
use dehumidifier to pre dehumidify air before it enters the return plenum. Similar to ERV, but better in the high humid south florida environment.
you need both supply and exaust. to keep static pressures balanced
Do not recommend
I DON"T KNOW
Dedicated Outside Air System (DOAS) or a system that is designed to handle outside air by reducing the latent load to an extent that does not raise the interior space relative humidity when supplying the outside air.
NONE AS YET
Outside air delivered to a dehumidifier. Then the dehumidified air would be delivered to the air handler.
none why would you want to pull hot humid air into a home?

I wouldn't even attempt to describe what you're emplying the cost and time would exceede the need.
Depends on zone and current humidity. High humidity outside air must be conditioned before introduction to house, via either dehumidifier or AC unit equipped with reheat or dehumidistat control. Low humidity outside air can be directly introduced via same distribution system when conditions permit.
N/A minimum FBC compliant house has infiltration through CBS, soffit venting, etc.
Bath exhaust timed with HVAC on off times.
Pull outside air at eave through return to go through unit for conditioning. Prevent negative pressure on house.
Continuous duty rated bath exhaust with on off switch
dehumidifier with outside air supply

Statistic	Value
Min Value	1
Max Value	8
Mean	3.47
Variance	4.77
Standard Deviation	2.18
Total Responses	289

14. Estimated cost ($) of this system to the builder including equipment and installation:

Text Response
2000
1250
2800
5000
3
15000
1000
895
120
1500
400
200
450
2000
1500
1,500.00
2500
300
750
400
500
8,500.00
275
400
2997
2500
2500
365
750
809
500
2800
1000
100000
8000
2,000
2000
4000
2500.00
800
1000
400
100
1000
1000
1500
750
2500
250.00
500.00
750

1000
500
500
3500
250
2500
3500.00
250
300
600.
300
4300
1700
450.00
475
1800
200
350
100
500
200
150
2500
470
125
250
1000
300
6000
5000
500
400
600
500
2500
600
2500
3000
600
2500
3000
1250
450
1500
1500
450
1200
1500
2300
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	242

15. Comments on estimate:

Text Response
$1200 for ERV, $600 Installation Materials, $400 Labor, and $600 Overhead & Profit
AC tonnage will increase to dehumidify and cool the hot, humid outdoor to be brought in; mechanical fan with damper; ductwork to the exterior with screened opening
motorized ventilation damper interlocked with ahu fan motor
This is completely dependent upon the type of product installed
Panasonic or Aprilaire systems are easily installed for approx $450 to $500
Price will be highier or lower depending on the size of the home.
18 seer trane system with fresh air intake and humidity control
Assuming home already has a programmable thermostat that interfaces with mechanical damper.
Can be costly to maintain all spec clearing and service requirements
Includes electrical
if you require the systems to be tested, retested and comply with some value that is to costly to achieve than it defeats the purpose to try to regulate the process.
Extra labor time to make sure system is totally sealed, including boots to ceiling. Motorized damper to bring fresh air into return at air handler. Filter box at air handler and insulated duct and gravity dampers to exhaust the old air.
Again, this mandate must have immediate payback and be self funded, preferably by the industry which it intends to benefit (utility providers). Few buyers care about whole house ventilation system, especially in a 2,000SF home nor do they request this self imposed system. They merely seek a responsibly built affordable home. Regulation are juxaposed to affordability and whole house ventilation systems are a rich mans game.
Cost can vary depending on the contractor and amount of duct work needed for ventilation. Cost can also be effected by the amount of ventilation needed and upgrades desired. Cost may also increase depending on the thermostat that the builder normally uses.
To do it correctly will require a a filter at the source of outside air, and a backdraft damper to minimized the quantities.A sensative pressure sensor near the main return would activate the fresh air fan.
If you only do wall controls and timers with a better than normal exhaust system the cost shouldn't be too bad, but if you have to put in a system that runs with the a/c, the time and cost will increase and also the humidity in the home.
it would be dictated by the size of the house
dehumidifier controlled properly introduces possative dry air to the home in our climet conditions.
could be much higher if load on house increases or need for better latent load controlling system like variable speed or 2 speed
Cost will come down with more installations.
electrically controlled damper
Best case in our climate
PENDING UPON AMOUNT OF VENTILATION. A STANDARD HOME REQUIRING THE MINIMUM OF 45-CFM SHOULD BE ABLE TO BE PERFORMED WITH AUTOMATIC DAMPER TIED INTO THE HVAC SYSTEM AT THE STARTING AMOUNT INDICATED.
Dependent of ease of installation
need only upgrade bath fan to qualifying type
A/C contractor same amount of work-up grade of materials. More framing and sheet rock. Some builder creativity on duct work placment
This is for typical Honeywell 5101 controller and Damper installed on a isolated run to outside, 6" flex or 4" dryer duct
none
unknown
This is a very costly item at around $3,000 per home, but the impact to sales price is even worse, adding about $4,000 to the sales price of a new home.
Builder would doing the very minimum to keep cost reduced. What good would this testing actually do for the consumer?
Clients will not want this and it will be painful. Clients will not use how intended so it's not going to work. Also, when we mention a controlled air intake to homeowners the let us know they don't want it or tell us they will disconnect
exhaust only may be an option if a dedicated make up air vent with filter and damper is installed. This would resuklt in a substabntial resuction in cost.
This includes a panasonic ERV, associated ductwork, additional electric, and labor, plus a return visit to set the proper time setting for the ERV
many hard costs still unknown as well as time costs
This is the cost for hard duct installed from an exterior vent cap to a time controlled damper that ties into the return of the air handler. Plus, the HVAC system may need to increase in size to account for the additional load to condition the hot, humid air that is now being pulled into the home through the fresh air intake.
not including permits; ERV install and wire $1200, HVAC fresh air in w/ controler $550
As a rater I am not privy to the cost or time of installation.
I believe the price varies on square footage of the house and tonnage of action unit
Use an existing hall bath and install energy star exhaust fan with ashrae a 62.2 ashrae compliant controller
Equipment manufacturers are making units now that comply with the needs for this due to code use in South Carolina etc. This should not be a surprise to anyone.
With home owner option educated to overide control.
Cost should actually be part of the A/C system package.
depends on the brand
Estimate based on experience of having such equipment & installation back in 2005 - 2007 on similar square footage with foam insulation (iceneene) to roof decking in attic areas.
labor mateials

System system will require filtration, motorized damper with humidistat control, inline manual damper and separate mechanical dehumidifier if built in coastal city
Basic bid
depends on type of Air Duct Material used.
just a guess
to many unknown factors to give honest estimate
If a dehumidifier is used the cost would increase to $3500.00
could go up or down depending on size & location
Based on material onlu
ERV should always be used in Florida due to high humidity.
depends on number of units and cfm required
per sf
home owner savings goes on and on.
Need a filtered fresh air supply duct and a motorized damper controlled by the operation of the HVAC.
SWAG Need contractor's pricing, not Rater"s
at 4 people, 15 cfm per person = 60 cfm. it costs about $2/cfm/month to operate, which equates to about $1440/year to operate!
just a guess
The outside air system is a combination of a controller and a damper. This would require a roof jack, 6” round connecting duct and tying in to the return air duct on one of the systems. This add would generally be priced around $1,200.00) The whole-house dehumidifier is one of the standard models we use. This unit requires two duct connections to one of the HVAC systems and would have an installed price around $2,400.00.
do not know specific cost of unit or installation. lack of knowledge of this equipment
Either upgrade to a better AC unit equipped to do the job, or a dehumidifier integrated into the AD duct/distribution system. To consider introducing unconditioned outside air into a house in zones 1 and 2 is a disaster waiting to happen.
Been doing this for years now.
The typical system we've been using is AirCycler G2k
Infiltration not addressed?
Mechanical contr. installation and additional capacity of system
This cost is per air conditioning system
I really don't know -- I'm guessing, since I haven't had the experience of this installation yet. I have a project nearly ready to permit, and will learn the costs associated with the code requirements.
All Bath fans and Kitchen hood
Not sure; do know Habitat Houses doing something similar to meet Energy Star.
ducting to exterior and interface controls can easily add 1000 to price
100

Statistic	Value
Total Responses	75

16. Estimated time on-site in hours (Answer must be a single number e.g. 0, 25, 405)

Text Response
4
6
12
30
3
20
16
2
4
4
1
4
24
5
48
2
6
1
2
24
2
3
20
32
8
2
4
16
4
8
12
50
8
2
4
8
5
40
2
0.5
2
5
12
4
2
8
8
4
4
1
8

2
10
12
1
1
8
1.5
3
4
2
3
4
1
2
0
8
2
1
4
4
2
5
8
1
32
2
1
3
4
6
8
1
4
6
8
6
1
4
2
4
6
2
8
8
6
1
2
3
8
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	220

17. Are there any factors that would likely warrant a substantial increase or decrease in your cost estimate for the EXAMPLE HOUSE?

#	Answer	Bar	Response	%
2	Decrease		36	32%
3	Increase		102	92%

Decrease	Increase
	Inspection lag. Correct work. Leaks. County compliance.
	Larger and/or multi-level houses.
	If the design specified supplying a separate AC system just for conditioning the outdoor air intake
	Having to retest
Size of home	Size of home
	Price increases
	1000
	Required clearances and intake modifiers
	time
	yeah government regulations
	More materials, labor and design time on each job
	Cost of sealing the house and ducts to meet code along with the testing and re-testing fees
	Existing conditions
	TIME
Shortened duct length.	House with multiple systems. Long duct run. Requested upgrade.
	Improved indoor air quality. The other ventilation methods would lead to substantial risk and likely moisture damage to the home and it s contents
	Placement - Location - Feasibility
Short OA duct.	Length of OA duct; issues with the pressure sensor, and maintenance of all components.
If the ASHRAE standards were really looked at for Florida hot humid climate to determine that 5 may be to high of a number to force ventilation.	If the ach50 is much less than 4, then the home will end up with make-up air and ventilation pulled through the air handler, this gets very costly. Also timers and brands of exhaust systems in the bathroom to meet the proper cfm can be very costly. Including the cost of extra dampering to keep air from winds or storms from blowing back in.
size of house	size of house
	Increased time, cost of the ventilation system, and maintenance.
Same	Distance and route to be taken of duct
	the size of dehumidifier required for the size of the home, they range from 70 pints to 205 pints per day. 70,98,100V,105,155,205
	see above 2 speed or variable speed system
No	No
	Cost of compliance will not provide a return on investment, especially for affordable housing.
NOT HAVING THE NEED TO DO THIS AT ALL, OR CHANGING THE REQUIREMENT FOR VENTILATION JUST BECAUSE THE HOUSE IS BELOW 5 AIR EXCHANGES PER HOUR	MORE GOVERNMENT REGULATION
	Distance to travel
none	none
	Air handler in conditioned space -upgrade material-time in planning lay out of duck work.
Size	Size
	If additional ventillation is required, lawsuits related to mold and humidity problems when these systems fail could be in the $millions.
	none
no	no
no	no
	These pieces of equipment are very expensive and production of them has matched demand - which has been very low.
	Cost of labor, materials, time, electric etc.
Practice - once it is implemented a few times, it's fairly easy.	Education - not knowing what to do.
	$1000
No decrease the price is the best deal and you would have to wait for contractor to have a dead time in his schedule if you need it when he is busy just double the price.	It was assume going thru gable wall, going thru roof add $600. Two-stories with 1st floor could range from $300 to $2000 more depending on floor joist design and any required soffit. for ERV. The new A/C has to be resized and increase to cover the extra incoming air. average adds $1,500 more.

none	none
Opposite of above	Long duct lengths, access to entry and exit louvers/grills
	Poor construction coordination, value engineering, weak subcontractors.
easy attic access	flat roof
job conditions	job conditions
	Room allowance for equipment installation
	Family activity, glass , insulation
Easy access for outside air duct opening and duct run.	No easy access for outside air duct opening and duct run.
	use Sheet Metal Duct/ and Foil back Duct Insulation.
	Retro fit
	Increase in scope, time and money
	Space
No	No
	Install dehumidifier for outdoor air.
	how could it not add cost
	obviously more ducting, controls and dampers
	Time and material. An Air Conditioning unit is not a ventilator!!! Must have independent source. ERV, BVS. NOT to tie to the RETURN OF AIR HANDLER !!!
na	na
	Everything that code asks for is an increase in un-necessary costs.
	another step involved in the building process, another inspection, another document required, another step by the contreactor, = more time= more $
No, with a tight house you must add pre-conditioned air into the house to make up for kitchen and bath fans.	This system works best in our southern climate because we are not pulling in hot moist air the majority of the year. We build ICF block houses that are very tight. We don't need unconditioned air being added to our houses. The cost of whole house ventilation would not only add to the cost but to the homeowner ever month because of the HVAC running more to overcome the unconditioned air put into the house.
	at 4 people, 15 cfm per person = 60 cfm. it costs about $2/cfm/month to operate, which equates to about $1440/year to operate!
no	no
	Our homes are extremely tight, and would probably need the outside air to generate the 5 air changes requirment
	travel
quantity and experience gained in the process. And the lower prices for the equipment once they became standard requirements.	lack of understanding on how to do it right, a negative attitude in wanting to do it and lack of concern for the health and comfort of the occupant, and a lack of concern or ignorance about the energy savings that would be achieved by the occupants being comfortable at a higher temperature when the air is drier.
None	None
	change orders insulation changes
not sure	not sure
	With anything new, you always have "hidden costs" that do not appear until after you start doing it.
Go to an exhaust only strategy	Going to Balanced system with HRV/ERV
	serviceable location with access needs to be provided unless ceiling mounted model is used. control wiring and control for remote set up
	yes if ad any more changes to the existing code
	Cost of new technology or of mandated technology.
The more houses are tested, the lower the price should become.	
Delete this code	
Use exhaust only as indicated above.	
Use of equipment designed for this environment to comply with the code.	
Increased competition for sales of dedicated outdoor air systems.	
Much cheaper is to use a simple outside air duct with motorized damper connected to the heat pump fan (damper opens when fan is running), but it is highly inefficient, especially when humid outside.	
Less expensive equipment can be used	
Had more information on cost. I'm not a contractor.	
acess	

Statistic	Value
Min Value	2
Max Value	3

Total Responses	111

18. Would you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE?

#	Answer	Bar	Response	%
1	Yes		184	60%
2	No		87	28%
3	I don't know		38	12%
	Total		309	

Statistic	Value
Min Value	1
Max Value	3
Mean	1.53
Variance	0.50
Standard Deviation	0.70
Total Responses	309

19. If you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE, please estimate the cost and describe the changes needed?

#	Answer	Bar	Response	%
1	Estimate cost ($) (Answer must be a single number e.g. 0, 25, 405)		144	95%
2	Describe the expense		105	70%

Estimate cost ($) (Answer must be a single number e.g. 0, 25, 405)	Describe the expense
2000	Testing. Equipment. Lost time. Compliance.
1200	We typically see a 1/2 ton increase in equipment size to overcome to heat gain from the ventilation product.
1000.00	
1500	added cost from sub contractor
2,500	
1000	Increased tonnage to condition hot, humid outdoor air intake; motorized damper; more sophisticated controls
1500	
4000	Additional equipment needed to supply proper ventilation.
500	
600	Air handler in most cases will have to be increased .5 half a ton to help reduce the added RH%.
600	Increase in unit size. Extra outside air filter
1000	add one duct for fresh air additional cost for the special air handler
250	minimal as it would be part of design
1000	air filtration (salt removal) extra fan with power/wiring/controls
800	Larger system, means larger duct work, means more expensive
500	roof penetration(s), additional electrical hookup. additional ducting
5000	
2500	
750	Variable speed airhandler and ventilation/dehumidification controller
300	
3000	Equipment would need to be slightly oversized to compensate for the warm outside fresh air. And I would recommend to my customer to go with, at minimum a two stage system.
5000	cost of extra duct-work and control damper for outside air to be brought in
1500.00	additional capacity for ventilation requirement.
1500	
1,000	Would need to install variable speed Condensing Unit.
500	having to overcome additional outdoor hot, humid air (most months) when cooling
3000	To do this in our humid climate would necessitate a two-stage outdoor unit, or a dehumidiifer added to the central system.
2000	larger plenum, more tape, more mastic, additional piping, cut into the roof and piping to go higher than the roof plan, items to keep the roof from leaking with the new penetration.
2500	You would either have to increase the capacity (especially latent) of the AC equipment or install a dehumidifier.
3500.00	
1000	Additional energy efficiency, additional equipment, additional ducting, and additional labor.
1200	
3500	as noted in the last question
2000	better equipment 2 speed or variable speed
500	If the outside air is not dehumidified completely before introduction, the equipment tonnage would increase to handle the additional latent load.
3500	If untreated air is brought in to the a/c system there needs to be some way to increase the latent heat removal
0	
1000	Additional BTU capacity
1000	Adding humidity will require two stage equipment to keep the indoor humidity around 50%. Or a dehumidifier which will cost more for a whole house model
250	
500	Need to rework the supply and return air ductwork if the plenums are not sized large enough for connections from the ERV
350	Increase in equipment size or type
0	

1,500	HVAC- Size of unit increase could cause install concerns or space required.
2000	Whole house dehumidifier
750	Connection of communication duct to outdoor air, controller, damper, duct, and labor to install and seal
2500	Whole house dehumidification systems will become the norm once houses are required to be too air tight.
1000	
500	
450	Bringing hot humid air into the home will require different units to effectively handle it.
500	
2000	added capacity to counter effects of ventilation not factored in manual j
400	Possible increase in cooling, heating load
0	unknown
500	system engineering, manual j calcs
450	
1000	The HVAC contractor would need to add a dehumidification to the system. Any time warm moist air is added to a tight home, additional dehumidification needs to be added to remove the moisture
0	cost actually goes down on the AC if you use the open cell foam as you use a smaller size system.
1500	single stage to two stage system
900	it could increase the size of the ac system
500	damper control to allow fresh air in while system is operating.
500	
300	
150	This is a cost allowance to increase the size of the system by 1/2 ton.
300	
1500	multiple manual-j's and increase a/c capacity $1,500
500	Extra HVAC capacity to overcome the added load
500	
1800	
1500	Larger ac
300	
700	It may require higher SEER unit and additional ductwork with change in material
1000	
350	
350	
150	redo load calculations
2600	Equipment would need to be sized to include O/A temperature and humidity load..
500	
300	Additional fan and electrical connection costs. Everything else should be considered in the system design. If constructed well, additional capacity should not be warranted.
2000	upsize ac system wuth variable speed a/h
800	
9500	Upgrade in A/C equipment as well as upgrade in attic insulation, wall insulation, windows and doors to meet these criterias, cost of testing and reports and extra charges from building authorities to review the information.
1500	Enlarging the system tonnage due to increased heat load on building
500	Changes to duct system to interact with erv
2000	
0	Cost may be zero but system needs to be sized appropriately to account for outside air being introduced
1500	increase in btu of system
1100.00	Air handler to be variable speed matched with thermidistat control
2220	Equipment ,labor
400	Run additional ductwok
1200	
400	
600	
750	Higher than min. code requirement,
650	Larger or higher efficiency unit
900	New specs , equipment , seals , insulationbaffles , house wrap requirements

1000	Upsizing of system to accommodate fresh air
0	
2500	up grade of seer rating , unknown to me exactly how much this testing will cost
2500	

This table has more than 100 rows. Click here to view all responses

Statistic	Value
Min Value	1
Max Value	2
Total Responses	151

20. If blower door testing is required in the FUTURE, who would you expect to offer blower door testing services (select all that apply)?

#	Answer	Bar	Response	%
1	Home Energy Raters		187	59%
2	Utilities		41	13%
3	Weatherization professionals		75	24%
4	HVAC contractors		180	57%
5	Insulation contractors		64	20%
6	Energy Code calculation providers		69	22%
7	Builders will test their own homes		44	14%
8	Other, please describe:		44	14%
9	I don't know		18	6%

Other, please describe:
Test and balance testers in the HVAC industry
or any trained 3rd party contractor
RESNET approved techs
Not practical
Code enforcement partnership with utilities.
Testing labotatories
Anyone certified to perform the test.
NONE
crooks, thieves and liars
Those who are familiar with ventilation and how a system works.
And done at no-cost
a third party tester not affiliated with the builder or sub contractors would be required by most jurisdictions
Waste of time and money if builder is doing his job and inspectors are too.
In Florida code it says that only certified raters are allowed to do building envelope and duct testing. So we are the ones that I expect to offer the services.
Mechanical engineers
Clas 1 Florida Energy Raters, best choice
HERS field inspectors
Only qualified pro's that have passed core testing! and are licensed and insured
test and balance companies
Foam insulation contractors
Engineering Consulting firms that provide testing and inspection services
The equipment and testing is really a waste of money for the homeowners. The estimated savings is never accurate because every family lives differently and the testing is based Soley on a set standard.
BPI, and RESNET certified people should be the only people doing the test. Independent from the builder. Blower door testing on a gas home can be dangerous if someone is not trained properly. this is not a one day course to understand the properties of house science.
Only BPI certified contractors, they have more knowledge and understand if the house is to tight what effects not only moisture has but the ability for a gas appliance to draft and or kill someone. Not Resnet as they have seen less unique and odd homes.
Those who have taken and passed a course on blower door testing, and who are somehow regulated--ie: DEPR, CILB or BPI, RESNET.
Certified building airtightness professional
County approved independent testers.
LEED/FGBC/NGBS third-party green home verifiers
BLOWER DOOR TECHNICIAN UNDER SUPERVISION OF HOME ENERGY RATER CERTIFICATION.
new profession "Door tester"
Mechanical Engineers
All will want to for various reasons. Depends on training requirements of testers.
IT ABSOLUTELY SHOULD BE PERFORMED BY INDEPENDENT THIRD PARTY INDIVIDUALS, WITH RANDOM AUDITING AS IS CURRENTLY PERFORMED BY FSEC!!
RFI
BPI
independent licsensed BPI, or equivent certifications
Although there are lots of various options for people who can perform such testing services, I think it'd be best to consult with the County Building Officials for direction and recommendations.
Existing T&B subcontractors

third party
Most all of the above, whether they are qualified or not. The consumer will look for the lowest cost just to get by the code. They are not interested in the value of the test.
Specialists who concentrate solely on the blower door test and remediation efforts to help contractors achieve the required results.
Home owners
Someone who is third party. Builders don't need to police themselves, unless FSEC is doing checks and balances on the builder provider. A lot of builders tell me they will depend on their HVAC guys for this.
Homeowners

Statistic	Value
Min Value	1
Max Value	9
Total Responses	317

21. If blower door testing is required in the FUTURE, do you or your company intend to conduct or offer blower door testing services?

#	Answer	Bar	Response	%
1	Yes		141	46%
2	No		168	54%
	Total		309	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.54
Variance	0.25
Standard Deviation	0.50
Total Responses	309

22. Have you or your company already acquired training to conduct blower door testing?

#	Answer	Bar	Response	%
1	Yes		99	70%
2	No		42	30%
	Total		141	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.30
Variance	0.21
Standard Deviation	0.46
Total Responses	141

23. Which of the following best describes the type of training you received to conduct blower door testing?

#	Answer	Bar	Response	%
1	Self study		5	5%
2	Certification program		81	83%
3	Industry association training		10	10%
4	Other		2	2%
	Total		98	

Other
HERS rater
HERS

Statistic	Value
Min Value	1
Max Value	4
Mean	2.09
Variance	0.23
Standard Deviation	0.48
Total Responses	98

24. If there were no changes in your current capacity and work load, estimate the number of additional blower door tests you could conduct annually within your normal service area. (Answer must be a single number e.g. 0, 25, 405)

Text Response
150
30
0
50
1
500
12
500
800
600
100
4
50
6
12
100
10
400
0
20
4000
200
300
0
25
40
200
25
100
200
200
1500
200
500
0
300
1500
500
430
1300
10
0
100
60
100
20
250
100
50
30

500
200
30
52
0
120
100
50
200
1000
350
1000
200
1000
2000
200
50
0
520
2000
600
500
25
100
100
600
50
400
100
150
25
2000
100
200
0
100
1
30
0
60
800
1500
200
5
0
100
1500
10
5000
100
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	128

25. What resources would you need to double the number of blower door tests annually (select all that apply)?

#	Answer	Bar	Response	%
1	Additional training		39	28%
2	Additional personned		92	67%
3	Additional equipment		86	62%
4	Other		7	5%
5	Nothing		17	12%
6	I don't know		8	6%

Other
We can't as we offer it only with our own efficiency program
we pay the rater
Funds
more avalable jobs
already have a second BPI cert Tech on staff
Additional training for new personal
additional personal and equipment

Statistic	Value
Min Value	1
Max Value	6
Total Responses	138

26. If whole-house mechanical ventilation is required in the FUTURE, will you or your company be involved in specifying such systems?

#	Answer	Bar	Response	%
1	Yes		198	62%
2	No		120	38%
	Total		318	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.38
Variance	0.24
Standard Deviation	0.49
Total Responses	318

27. What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to comply with Florida Code requirements if/when the legislative delay ends (select all that apply)?

#	Answer	Bar	Response	%
1	Exhaust only (excluding occupant controlled kitchen and bathroom fans)		49	25%
2	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)		32	16%
3	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)		98	50%
4	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)		64	33%
8	Other, please describe		29	15%
9	I don't know		15	8%

Other, please describe
Balanced with exhaust fans and damper to allow for fresh air. .so basically a balanced system.
ventilation air of proper amount, 15 cfm per occupant, provided during runtime only is proven very effective to pressurized / eliminate infiltration
We would specify thew simplest system with lowest cost. Its interesting a requirement such as this is passed, or a trial ballon floated, without a cost study and then seeks input from those upon which it is to be imposed after the fact.
use what is needed for code
Supply only Ventilating dehumidifier Supply with exhaust (positive pressure to slow down infiltration throughly building leaks) Ventilation with temperature and humidity cut offs
Coupled with some means to control the added latent load.
see above discriptions
And the mechanical whole-house dehumidifier.
Whole house dehumidifier
I have been installing 15 / 16 SEER Variable speed air handlers for the last several years, and installed a mechanical damper/controller. full foam house with 1/2" dow blue board on most homes (est. 15 homes)
specifics would be determined by my mechanical engineer
depends on the location dewpoint temperature, type of construction, habitability and typicall ari infiltration rates expected
This would be the least cost and consumers don't care about all the fancy gagests they want a home they can afford. We are really making affordable housing a thing of the past and we are going to loose a whole market of consumers that can no longer afford a home.
Add fresh air intake to the return plenum of the HVAC system.
dehumidifer
I don't agree with mechanical ventilation for all instances in Florida. In many cases, the outside air is far more dangerous than stale inside air. Especially in instances with high pollen and pollution. Cleaning the air prior to introduction is not cost effective. No such thing as Exhaust only ventilation. If you blow air out, it has to come in from somewhere and that is not always a controlled or desired source.
It has been my understanding that point source exhaust fans such as bath and range WOULD count toward the code mandated total
Whole House Ventilating Dehumidifier
Whole house dehumidification added to supply intake
again you need balanced approach, both supply and exaust
supply with mechanical dehumidification
It's all an expense that home builders and home owners don't need in this economy.
Dedicated outdoor air systems and possibily the use of an ERV.
Dedicated outside air with manual and powered damper ducted to a stand alone dehumidifier with controls
Outside air delivered to a dehumidifier. Then the dehumidified air would be delivered to the air handler.
Based on test will decided what is needed
continuous duty rated bath exhaust with on off switch - per ASHRAE 62.2
Exhaust and Supply
dehumidifiers with filtered outside air

Statistic	Value
Min Value	1
Max Value	9
Total Responses	196

28. Why would you specify this/these types?

Text Response
Preconditioning outside air is critical to energy savings and maintaining net positive building pressure.
It can be controlled by the air handler
Builders requirements and budget. All are different.
Intake air must be filtered and conditioned before being brought into the space or one is asking for mold trouble by just dumping hot, moist air into the interior. It is self defeating to button up a building so tight to then cut a hole into it to bring in outdoor air.
yes
Other systems would waste to much energy
They work. Tested these systems in GA & TX
Best way to bring in outside sir
Ease of installation and cost effective
most efficient
cost
Only to comply
Cheaper than the right way (which is a dehumidifer)
have used
code requirments
to avoid extra humidity being introduced into the house causing mold issues
depends on the house size
seems to be most efficient
It is important to remove off gasses from inside of the home as well as remove carbon monoxide from gas cooking appliances or invented gas fireplaces that vent the gases into the living space. Having a supply strong ventilation system will keep unwanted outside air outside of the home. The outside air that is brought on is filtered and dehumidifier thought the AH filter and coil which provides increased comfort and safety to the homeowner
Most cost effective and most reliable design/system.
The non-energy recovery systems would introduce unconditioned outside air into the home, or introduce it sporadically, which would lead to greater indoor air quality problems than no ventilation system at all
Keep first cost down, and minimize maintenance costs.
We currently recommend these systems in houses insulated with foam.
exhaust because of lower cost. ERV much better choice for effectiveness and practicality
Trying to keep the homeowner issues to a minimum in regards to cost and operation.
we have been installing this type of system for well over 10 years with good results, and have solved problems in existing homes.
to help control the latent load added to the house
The outside air must be dehumidified prior to introduction to the house or the risk of mold and etc from high humidity is unacceptable.
It has been working for my clients for 10 years.
Proper sizing. one contractor.
SEEMS LIKE THE BEST OPTIONS TO MEET THE CODE, BENEFIT THE CONSUMER AND MAKE IT THE EASIEST FOR ALL PARTIES INVOLVED
cost
Applicable for the temperature and humidity levels in Central Florida
only thing required by code
Gives some dehumidifying capability and puts house under positive pressure.
Most cost effective
Simplicity, cost effectiveness.
To keep a slight positive pressure in the house. We don't want a negative pressure in the house which would suck humid air into the walls which would cause mold and be an energy penalty. We want to dehumidify the incoming air with the air handler or an ERV.
Control humidity
Ease of installation, minimal cost
Simple to install, minimal additional equipment, minimal homeowner involvement.
Simple to install, Conditions outside air as it enters the home.
Seem to be the most affordable at this time.
Been installing them for several years and have had no problems.
a good and better scenario options for the builder/homeowner. I think builders will use this law to justify extra building costs and be able to blame it on the state
Humidity control
these two can work in tandem to provide sufficent ventilation at a reduced cost
to meet code requirements and provide a tight building envelope
To meet the code requirements

Experience
Because of the varied home stock available
Because in a HOT and HUMID environment, such as anywhere in Florida, to bring warm, moist air in from the outdoors without first conditioning the air to remove moisture, is something only an idiot would do on purpose. Over the past 30 years we have seen lots of very bad unintended consequences come about as a result of great sounding ideas, this feels like one of those... What if we have some smoke in the air and bring in all that "fresh" air - full of smoke into the house without first filtering the smoke out? We could injure the occupants of the home by allowing this to happen. Who wants to be responsible for that?
Least cost
Because we would need to leave it up to the homeowner. The homeowner would drive which way they wanted to go
ERV first as a balanced system will perform better is cost is not an issue. The others if cost is an issue.
The ERV has an addition of air along with the removal of air thus balancing (in theory) the air. The fresh air into the return plenum allows the warm moist air to be conditioned (dehumidified) and moisture to be removed.
They work best with the building science we use on all of our homes already.
more control
Good solution to manage indoor air quality.
most efficient
We would install supply only to create a positive pressure on the inside of the home, because we are in a humid climate. Exhaust only could create a negative pressure, which would pull moisture into the home (his is an undesired condition). And, energy recovery ventilators are too expensive.
Code compliance
Cost is less, it dehumidifies most of the time when a/c is running, it's easier for a a/c guy to understand and any home pressure would be relieved through the spot exhaust ventilation piping and damper even when not running.
efficiency, better humidity control
Latent heat removal
Our climate demands that if outside air is used, it must be dehumidified. Using an air handler with control and an erv allows for some humidity control. Additionally, it provides better source control and distribution of outside air to the conditioned spaces.
runtime with Hvac best for dehumidification, filtration and positively pressurizing the home. The exhaust fan method will be more cost effective for builders entering this arena for the first time. Teach them to walk then run...
humidification of outside air is important
Cost by builder and competition ability plus cost
CONTROL SYSTEMS ARE INCORPORATED INTO THE AIR HANDLER CONTROLS FOR AIR MOVEMENT. ESTABLISHES ENVIRONMENTAL CONTROL OVER THE SPACE AS WELL AS THE NUMBER OF AIR CHANGES.
cost and simplicity of meeting requirements
Most efficient, and will precondition fresh air entering house at the air handler.
cost
better for energy consumption and they dont create a pressure difference in the home. less dirt infultration
Help condition the air due to high humidity levels
One for install cost, one for operating cost.
lease intrusive.
Ensures that outside air is introduced only when the AC condenser is operating thus not to load the house with moisture
Energy efficient and practical.
Intake air will be between 60 to 70 relative humidity
Best for the money
Better air quality for all Florida residents.
Most effective
No comment
compatible with cost effective Equipment.
Simple and very little cost.
I don't want to do any of them. The customer is burdened enough.
Less cost impact on both builder and consumer.
every situation is different, but we have to do what the code tells us. We need to pre dehumidify the air before it enter the coil, so ERV/dehumidifiers are the best option down in south florida
yes
it would be balanced, not creating a negative pressure(exaust with no supply) or positive pressure (supply with no exaust)
Control dehumidification and cleanness of intake air
-With the exhaust system you can get a good estimate of the infiltration and possibly undersize the equipment to help control the humidity by having the equipment run longer (bc it is undersized). -With the supply only system with runtime control you are at least removing some of the moisture from the ventilation air.
Cheapest, easiest for homeowner to understand and can control personal preferences and not a "standard"
Cheapest
Florida has high humidity. You can't just add a 6 in run to the return of an air handler and possibly think that is fine. Direct humidity to a unit that was sized for the inter loss/gains is not correct. You also need to make the building positive in pressure, not negative.
high humidity concerns and mold and mildew

IT IS THE ONLY WAY TO REDUCE OVERLY HIGH HUMIDITY OR OVERLY EXPENSIVE EQUIPMENT
cheapest and simplest
costs
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	131

29. Are there any types of whole-house mechanical ventilation system you would not specify to comply with the Florida Code requirement?

#	Answer	Bar	Response	%
1	Yes, please describe which system(s) you would not specify and why:		72	42%
2	No		38	22%
3	I don't know		61	36%
	Total		171	

Yes, please describe which system(s) you would not specify and why:
Exhaust only (inconsistency, spottiness, unverifiable true production). Supply only not integrated with dehumidifier (would introduce too much moisture into the house
Any system that does not pre-condition the outside air or continuous intake without being treated prior to distributing into the building envelop.
Exhaust. Due to wet hot air in florida and it being a big problem making the house depressurize and the damage and comfort issues that come from that. Plus transplants from up north and out west where its drier wanting wood flooring that warps from humidity issues.
Absolutely. No systems that would just dump outdoor air into the interior without it first being dried out and cooled.
yes, i would not specify a fan only or exhaust only system without the ventilation air being conditioned prior to mixing with the indoors, the v/a must be introduced as close to the indoor coil as possible / runtime with call on cooling or heating - air handler fan only operates on a call for heat or cool (never continuously)
Definitely would not use or recommend heat pump in sw florida
Type that introduced outside air into the home without going through the hvac system
Systems which involve putting untreated air directly into the living space or into the air handler. Both of these options have side effects that builders and homeowners will not tolerate, except for the price for being code compliant.
Ventilation only The reason is because ventilation only forces air though the buildings leaked to try to replace the air being exhausted. This results in increased humidity inside the home and can lead to moister problems. If there are cumbustion appliances in the home having a negative building pressure will not allow the gasses to exit in the desired area and will lessen the amount of cumbustion air available.
ERV, not cost effective or efficient with Florida's high humidity level.
Any system that did not temper and dehumidify the incoming air, preferably through energy recovery
HRV's-Excessive maintenence and lack of humidity control. Whole house not connected to HVAC-no humidity control.
Systems that do not incorporate humidity control.
ERV systems, they have no affect on latent heat, only sensible. will create moisture problems if used.
supply air only just introduced into the house
System that bring outside air directly into the house or AC systems that allow outside air in when the cooling compressor is not running.
continuous ventilation
BLOWER BRINGING IN OUTSIDE AIR INTO THE HOME, 24/7 AND NOT INTRODUCED THRU THE HVAC SYSTEM
HRV does not allow for dehumidification.
unconditioned outside air introduction to house
Honeywell Y8150 due to excessive power consumption. Limited flexibility
Exhaust only ventilation because we don't want a negative pressure in the house which would suck humid air into the walls which would cause mold and be an energy penalty.
ERV. Won't control humidity in our climate.
Exhaust only, there is no control over where the outside air is coming from. Though it may be the cheapest, it may lead to future moisture problems in the room that contains the exhaust fan.
outside air ducted to return without accessible filter media
ERV
exhaust only
Positive pressure -- if the buildng is not properly sealed and has frmae constrution air exfiltrating has beeen know to condense in the walls/corners and only gets dsicovered later when mold or rot is present. Positive pressure exfiltraion ahs less predicable paths. Particularly during hihgs wind events.
Straight venting from the outside to the air conditioning closet, or ductwork, etc. or any other venting that does not condition and filter the outside air first.
I would discourage any system that uses the airhandler blower to distribute air due to energy costs involved in using such a large blower to move a very small amount of air.
Air intake only systems. They allow moist air into the home and trapped in a tight home.
HRV are not the best choice for a hot, humid climate.
As stated above, exhaust only systems could potentially create an undesired negative pressure on the inside of our homes. Pulling moisture into homes could create conditions that are susceptive to mold growth.
Exhaust only
No negative pressure unless I had really good insurance as 100% of all systems that suck air unbalanced out of the home will be covered in mold the first year.
HRV (would substitute ERV)
Any if they operate at ASHRAE 62-2 levels
ERV
any system that does not provide some sort of humidification. and exhaust only systems- we are trying to maintain a equal pressurized building while eliminating any uncontrolled air infiltration
CONSTANT VENTILATION OR MANUAL VENTILATION. WILL NOT PROVIDE THE NECESSARY AIR CHANGES IF NOT MANAGED.

exhaust only supply only
Exhaust - kitchen fresh-air. Bringing in high humidity
Exhaust only - This does not control where air is introduced into the house and could lead to building issues
Exhaust only, you are air through contruction material not intended to be filter material
Exhaust only, Florida has and will be utilizing Fuel Gas, especially Natural Gas. This presents problems the average skill level having been used in this state. Contractor as well as Employee.
Exhaust only.
hot/non pre conditioned air entering the coils. Also no way should we just have fresh air entering the space without being treated.
HRV and ERV - would not provide adequate dehumidification of the incoming air and would likely cause condensation in the occupied space Supply Only - most of the time in Florida you would be pumping in large amounts of hot and humid air into your cool space leading to condensation and potential mold growth
HRV - not good for hot and humid....
Commercial type sysyems
you mean like the current code allows. ERV's are used on all my homes.
supply into ac equipment
ALL EXCEPT ERV'S AND THEY CAN CAUSE PROBLEMS ALSO
Not pre conditioning outdoor air
Forced air independent of the mechanical system
There are too many to describe here.
I would not specify a system or method by which outdoor air is supplied to the house untreated (not dehumidified to 50% or less of space conditions). Introduction of outdoor air that is untreated will lead to uncontrolled relative humidity inside the house thereby providing thermal discomfort and providing a mechanism for potential mold development. So, those types of systems are direct ventilation through exhaust fans without equipment to treat incoming outdoor air from relative humidity.
I would not want to use the continuous run fresh air system because of our location in the southern part of the state. I think Hot moist air entering a tightly sealer house would be the worst thing I could do to our homeowners.
Exhaust only
There will be many problems if designers/contractors don't pretreat the humid air. Exhaust only provides negative pressures, seen in many mold infested homes. Supply only does not pretreat the air before it is delivered to the space, much like opening a door! Not a good choice for Florida. But if designs are made this way, we'll have a lot of work fixing the problems they generate!
I Believe their should be no outside air brought into a home in Florida
Aprilaire 8191 and 8192
Exhaust Only
Would not specify any system that allows large amounts of humid outdoor air in without conditioning the air and monitoring the flow to reduce wasted energy.
Exhaust / supply only - requires natural air leaks to balance. Natural air leaks in shell is infiltration.
Uncontrolled openings with opening that allow untreated air into structure.
Ventilation only using untreated outdoor air.
The Honeywell fresh air ventilation system. Runs on a cycle, turns on the blower to draw in unconditioned outside air.
supply continuous during hvac runtime
bring fresh air into the air handler, here in Florida, the air is full of salt and damages air handler coils.
exhaust only and supply only with no limit control

Statistic	Value
Min Value	1
Max Value	3
Mean	1.94
Variance	0.78
Standard Deviation	0.88
Total Responses	171

30. Considering your current capacity and work load, estimate the number of additional whole-house mechanical ventilation systems you could install annually (assuming one system per house) within your normal service area. (Answer must be a single number e.g. 0, 25, 405)

Text Response
20
20
50
1000
0
8
150
300
3
0
25
13
4
10
500
200
5
500
100
0
2
4
500
1
0
50
75
25
300
0
30
20
10
660
100
0
2000
0
0
100
400
0
5
1000
3
35
6
30
3
0

25
0
0
80
0
0
10
10
5
0
5
0
1,400
0
0
0
15
50
50
50
0
1000
0
100
0
200
0
150
10
2
50
6
100
20
200
30
400
25
15
2000
200
200
0
0
50
0
0
40
60
25
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	140

31. Please complete the table below for the blower door tests you have conducted or had conducted for new Florida homes over the PAST TWO YEARS. (Answer must be a single number e.g. 0, 25, 405): *Note: If the blower door test was part of a larger scope of work, please estimate what it would have cost the builder to have only a blower door test and the associated reporting.

Default - Tested for ENERGY STAR or other program certification		
% of Total Blower Door Tests Conducted (%)	Approximate Average ACH50?	Approximate Average Cost to Builder for Blower Door Testing* ($)
60	4.9	600
0	0	0
85	85	250
1	4	1,500
0		
10		500
10	2.5	250
66	4.5	175
0	0	0
15	2.8	400
1	4	750
10	3.75	125.00
100		250
4		1800
50	3	200
100	0.16	75
20	4.2	100
10	5	300
300	4.5	200
100	3.5	200
25	3.75	199
0		
0	5	800
75	3	300
100		300
100	3	250
0		
50	3	300
13	1950	450
20	4.3	200
0	0	0
100	2.8	600
100	2.5	450
0	1250	400
100	3	300
250	3.75	250.00
1500	3	400
60	3	350
2	5	0
100		300
90	4.98	250
70	2.0	450
0		
100	3	750
1	2	100
90	3	160
1	50	350
50	4	200

100	5	250
100	2.8	250
100	4	200
10		
0		
100	1	300
100	2.5	250
8	5.8	100
100	5	150
100	5	200
0	0	0
100	4.5	100
4000	4.5	150
100	7	700
30	4	250
50		500
25	4.9	60
100	2.0	200
98	4.5	150
35	5	200
3		
0	0	0
100		250
		1000

Default - Tested for optional Florida Energy Code (performance path credit or envelope tightness demonstration)		
% of Total Blower Door Tests Conducted (%)	**Approximate Average ACH50?**	**Approximate Average Cost to Builder for Blower Door Testing* ($)**
0		
10	4.2	600
85	85	175
1	4	1,500
80	7	250
3	4	250
50		
0		0
50	2.5	250
0		
10	4.5	350
1	3	750
180	4.5	125.00
0		0
50	3	200
900	5.5	200
0		
50	9	0
95	4	750
0		
2		
75	3	0
10	7	250
100	5	500
30	7	250
20	5	200
100	4	350
100	2.5	450
60	1250	400

100	3	1200
15	4	399
5	7	175
15	4.5	0.00
500	5	300
20	4	250
2	5	0
15	3.5	350
0		
10	4	160
100	4	400
10		
0		
100	1	300
100	2.5	250
100	25	1000
5	5	150
0	0	0
1	3	250
50	4.9	60
1	5	500
2	6.5	150
0	0	0
100	88	266
		250

Default - All others		
% of Total Blower Door Tests Conducted (%)	**Approximate Average ACH50?**	**Approximate Average Cost to Builder for Blower Door Testing* ($)**
40	6.5	450
90	3.5	800
85	85	300
1	4	1,500
6	5	600
20	8.5	300
40	4.0	450
34	4.8	150
75	5.5	350
100	5	0
80	5.0	100
90	6	300
75	3.75	199
2	6	180
100	3.5	300
5	9	1000
25	3	300
20	4	250
6	6	2500
20	10	250
20	8	350
60	4.5	200
2	3	250
0	0	0
100	6	225
100	5	300
200	6	150
15	8.0	350

100	5	1200
50	4	150
10		750
3		
25	10	100
0	0	0
99	5	150
4000	4.5	150
10	4	300
2	4.3	275
70	8	250
50		1200
65	3	300
		400
		300

Statistic	Tested for ENERGY STAR or other program certification	Tested for optional Florida Energy Code (performance path credit or envelope tightness demonstration)	All others
Min Value	-	-	-
Max Value	-	-	-
Total Responses	-	-	-

32. Based on past experience, what would you expect the ACH50 to be in a CODE-MINIMUM new Florida home (three stories or less)?

#	Answer	Bar	Response	%
1	ACH50		14	13%
2	ACH50 between 3.1 and 6		47	44%
3	ACH50 between 6.1 and 9		11	10%
4	ACH50 > 9		2	2%
5	I don’t know		18	17%
6	Comments		16	15%
	Total		108	

Comments
Sometimes more beau see of duct leaks and penetration leaks.
Only if the home is actually built to Code. Most failures are caused by errors not caught by Building Official.
Control infiltration with a slight positive pressure in the home and the ACH50 is not a factor.
I think below 5 is a good starting point for builders. Most of the new homes I tested were builder wanting to know how tight their house was and how then can get to under 5ach50. The majority of the houses that didn't meet 5ach50 were because contractors made penetrations through the buildlng thermal envelope and did not seal the penitearions, air barrier was not continuous, and parts of the house were missing insulation or were not air sealed. On the other end some of the houses I have tested were under 2ach50. Houses like this really need outside and the only you can possibly know is to test the house.
there needs to be a range, not just 5.0
Each home I have done as research for builders who look like they build well, but I didn't inspect as they built have all been 7-11%.
to tight is not good if indoor air is not cleaned properly.
This is a current average range as I've seen them
three stories over simplfies most dsigns whihc have cantilevered floors and other difficult air infitrtaion areas to seal.
These were done at no charge. They were done for "fun" to see how the homes performed.
Form a rating system like AFUE Energyguide seen on gas appliance. Let the consumer decide if they want a tight home for additional cost and then bring fresh air into the home to offset the humidity.
80% buliders already fall in the 3 to 5 ach50 range
Between 6.1 and 9 My old files not currently available.
This average should be around 5 and not allowed to be greater than 6. It only takes a little care and knowledge to accomplish this, not much money.
ACH=
I believe that most (non Energy Star) new homes would score between 4 and 6. Large luxury homes with triple SGD's would score higher.

Statistic	Value
Min Value	1
Max Value	6
Mean	3.10
Variance	2.99
Standard Deviation	1.73
Total Responses	108

33. In the PAST TWO YEARS, have you ever had a building delay of three or more days due to unavailability of house tightness testing personnel?

#	Answer	Bar	Response	%
1	Yes		18	17%
2	No		89	83%
	Total		107	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.83
Variance	0.14
Standard Deviation	0.38
Total Responses	107

34. What percent (%) of time were delays of three or more days experienced? (Answer must be a single number e.g. 0, 25, 405)

Text Response
10
10
50
100
7
3
1
100
30
45
100
1
5
25
10
50
90
20

Statistic	Value
Total Responses	18

35. What cost ($), if any, do you associate with a delay of three days in getting a test completed? (Answer must be a single number e.g. 0, 25, 405)

Text Response
50
6,000
2500
500
3000
500
5000
3000
500
1200
1000
1500
650.00
1500
0

Statistic	Value
Total Responses	15

36. Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems you have installed in new Florida homes over the PAST TWO YEARS and estimate the average cost for each type (Answers must be a single number e.g. 0, 25, 405)

Default - Exhaust only (excluding occupant controlled kitchen and bathroom fans)	
% of Total Installs (%)	Approx. Average Cost to Builder Including Installation ($)
90	350
0	0
100	300
15	500
2	2000
100	1200
0	
0	
7	210
0	
90	0
0	
90	400
100	400
0	
1	200
100	1000
0	
3	1500
50	500.
5	200
0	0
25	150
0	
0	
0	
70	350
100	1200
0	
0	
1	1000
0	
100	300
30	
20	150
0	
0	
10	1200
100	1200
0	
192	
0	0
100	1500
0	
0	0
0	
0	
5	
100	150

0	
100	1600
0	
0	
0	0
300	570000

Default - Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	
% of Total Installs (%)	Approx. Average Cost to Builder Including Installation ($)
0	0
50	100
.5	300
0	
0	
8	375
0	
0	500
1	1000
0	
0	
0	0
0	100
0	0
0	
0	
0	
4	880
8	300
100	
0	0
0	
20	
5	1500
0	
40	5000
0	
0	0
0	
0	0
100	1250
0	
0	
0	
0	0

Default - Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)	
% of Total Installs (%)	Approx. Average Cost to Builder Including Installation ($)
5	600
0	0
50	100
3.5	50
0	
50	200
30	150
0	
0	
3	100

0	
15	400
50	100
25	150
0	
0	0
75	150
0	0
100	0
2	480
95	300
0	
100	500
0	
0	
0	
100	500
0	0
10	600
8	
10	
5	200
0	
80	
2	900
99	600
70	600
0	
100	20000
1	1500
0	
11	4700.00
0	
80	400
0	
2	400
100	200
50	
0	
100	
25	40

Default - Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)

% of Total Installs (%)	Approx. Average Cost to Builder Including Installation ($)
40	400
100	100
80	350
0	
0	
85	250
0	
3	300
0	0
0	
40	450
100	500

30	3500
250	450
3	
100	250
0	0
100	300
20	350
0	0
0	
1	6000
0	
100	450
0	
30	2000
0	
0	
0	0
100	300
40	900
0	
10	
70	350
100	175
0	
100	15000
20	
50	
2	6500
80	100
0	0
0	
0	
0	0
100	50.
0	
100	300
10	
95	
0	
4000	200
50	
0	
0	
75	100
100	250
	8,500.00

Default - HRV (heat recovery ventilator) or ERV (energy recovery ventilator)

% of Total Installs (%)	Approx. Average Cost to Builder Including Installation ($)
5	1250
60	2800
50	100
1	3000
0	
100	3500
0	

0	
0	
1	2500
0	
10	2500
0	
5	400
0	
0	
0	0
3	2000
0	1500
0	0
5	1500
0	
100	
30	800
10	3500
0	
0	0
0	
0	0
5	3500
50	1500
0	
40	
0	0
0	
3	750
30	5000
50	
192	
20	400
100	1800
1	3500
0	
100	2000
0	0
0	
0	
0	
1	1000
0	
3	2500
0	
0	
0	0
	1,500

Default - Other, please describe:	
% of Total Installs (%)	**Approx. Average Cost to Builder Including Installation ($)**
20	2100
3	2800
0	
45	2000
200	2500

5	
0	0
75	250
50	11000
10	4000
0	
90	4000
100	
20	3000

Other, please describe:
Outside brought in through dehumidifier
Dehumidifer
none
Ventilating dehumidifier (upgrade option usually by request of homeowner)
Mechanical Whole-House dehumidifier.
Supply only: through a dehumidifier with runtime control(Ventilation air distributed through the a/c system only when it is on
None
Return side via control damper
I don't install systems. I only provide consulting and teating.
supply side only should have a built in dehu
hvac
Hasn't been required. Did include it.
None
no information available to me on the cost
Supply outdoor air via dehumidifier then into air handler.
Do not recommend to our customers.
Outside air delivered to dehumidifier to pre-treat. Dehumidified delivered to air handlers. Per system $4000 to install/$1440/year to operate. Our projects are extremely large estate homes, with multiple systems.
I meet ASHRAE 62.2 via a continuous duty rated bath fan with a labeled on off switch.
Condition the fresh air through a dehumidifier before introducing it into the home

Statistic	Exhaust only (excluding occupant controlled kitchen and bathroom fans)	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Other, please describe:
Min Value	-	-	-	-	-	-
Max Value	-	-	-	-	-	-
Total Responses	-	-	-	-	-	-

37. In the PAST TWO YEARS, have you ever had a building delay of three days or more related to whole house mechanical ventilation installation?

#	Answer	Bar	Response	%
1	Yes		29	22%
2	No		100	78%
	Total		129	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.78
Variance	0.18
Standard Deviation	0.42
Total Responses	129

38. What percent (%) of time were delays of three or more days experienced?

Text Response
20
50
100
2
1
50
10
10
50
100
1
40
50
20
50
50
5
75
50
10
50
100
100
10

Statistic	Value
Total Responses	24

39. What cost ($), if any, do you associate with a delay of three days in mechanical ventilation installation?

Text Response
1000
6000
2500
600
1500
2500
500
200
500
120
0
3000
450
15000
0
500
1000
1500
2000
900
500
1000
0
900

Statistic	Value
Total Responses	24

40. Why were the whole-house mechanical ventilation systems installed (select all that apply)?

#	Answer	Bar	Response	%
1	ENERGY STAR or other program requires it		62	46%
2	Builder standard practice		42	31%
3	Homeowner/buyer request		51	38%
4	Other, please describe		32	24%

Other, please describe
None required. Waste of money. Waste of time. Governmental interference.
Design required to meet comfort levels
Building official required it
HERS rating
We promote when spray foam systems are used
best choice for job
none installed
we did not install any
interview with the homeowner so they understand the benifts.
Foam unvented attics and projected house tightness.
Recommended by us
air exchange in homes with sealed attics
none
Heating and Air Condition
Good engineering practice
none done
in pursuit of highest LEED level possible
Hood venting requirement when CFM of hood vent over 400. Building officials required it.
Both were spec homes.
ASHRAE 62.2-2013
We install these as a standard any time we use foam.
Nonvented attic
We believe they are a worth while investment for the health of the population and educate homeowners. All the VOC's release in a home form products we buy, mainly from overseas, go in to our bodies. Have you ever wondered why cancer has escalated in our country?
Per our recommendations to the homeowner. We do most of our installs on the waterfront in South Florida.
calcs required them
LEED and FGBC certifications
1. To provide additional dehumidification-with or without outside air - which may be necessary during an event with lots of people in attendance 2. To offset kitchen hood exhaust as most hoods are over 800 cfm.
LEED certification
All mechanical systems that I design also have a four fresh air duct connected to the return of the air handler to provide fresh air and positive pressure.
iconene attic
It was best for the design and tightness of the home

Statistic	Value
Min Value	1
Max Value	4
Total Responses	134

41. Considering only YOUR MOST RECENT blower door test in a new Florida home (three stories or less), even if it was not typical of your work, please provide the following. (Answer must be a single number e.g. 0, 25, 405) Note: If the blower door test was part of a larger scope of work, please estimate what it would have cost the builder to have only a blower door test and the associated reporting.

Default - Most Recent Blower Door Test (Answer must be a single number e.g. 0, 25, 405)					
Month (MM)	Year (YYYY)	Approximate conditioned Area (ft2)	Number of bedrooms	Approximate ACH50 test result	Approximate cost to builder ($)
11	2015	3200	4	7	750
8	2015	3800	4	4.4	1800
11	2015	1500	3	50	350
8	2015	1250	2	4	1500
6	2013	2100	4	7	600
11	2015	2012	3	6.7	300
08	2015	1250	3	4	200
03	2014	1000	2		
10	2015	3300	4	2.7	450
11	2015	2420	3	5.03	150
08	2015	336	1	6	350
10	2015	2400	3	1.8	350
07	2015	336	1	5	0
10	2015	2880	3	5.79	800
10	2015	2700	4	3.59	125.00
11	2015	2034	4		250
1	6	2800	3		1800
06	2015	1400	3	4.07	1200
11	2015	1800	3	5.0	100
10	2015	4240	5	3.67	500
11	2015	2000	4	5	200
09	2015	3500	4	3.5	200
10	2015	2800	3	4.11	199
11	2015	2000	3	6.5	180
10	2015	4000	4	4	300
11	2015	5500	6	4.9	850
08	2015	1773	3	4.72	300
10	2015	1100	3		300
08	2015	1300	3	3	0
11	2015	2300	3	3	250
05	2014	1500	3	5	500
10	2015	3000	4	5	250
11	2015	1600	3	6	350
04	2015	3406	4		1950
11	2015	1942	4	3.48	380
06	2015	2798	4	5	450
09	2015	1932	3	2.8	600
6	2015	5000	5	3.0	450
11	2015	1600	2	1250	400
11	2015	2000	3	3	300
11	2015	1800	3	4	750
10	2015	8000	4	1.2	225
11	11	1960	4	4.2	399
10	2015	2000	3	7	175
11	2015	2245	4	3.21	250.00
11	2015	3000	4	2	400
11	2015	2100	4	3.2	200
11	2015	8000	5	4	400

6	2014	2000	4	3	0
11	2015	1200	3		300
11	2015	2147	3	6.87	250
11	2015	4600	4	833	450
10	2015	2200	4	3	1200
12	2014	925	2	3	750
11	2015	5000	4	2	240
4	2015	2600	4	50	400
11	2015	2200	3	2.5	40012
09	2015	2000	3	3	200
5	2014	2200	4	4	500
03	2014	3800	5	2.8	3500
11	2015	3100	5	4.89	200
11	2015	7200	5		3000
10	2015	2300	3	5.79	250
07	2015	1234	3	1	300
10	2014	3800	4	2.4	1850
05	2015	2400	3	7	100
10	2015	3000	4	.8065	500
12	2013	2000	3	0	1100.00
10	2015	1650	3	3	150
09	2015	2000	3	4	200
10	2015	2100	3	3	250
11	2015	2400	5	4.5	100
11	2015	2000	4	4.3	150
11	2015	21150	3	6.5	0
11	2016	2000	4	4.5	685
11	2015	1980	2	4.5	350
10	2015	4500	7	4.3	275
11	2015	2300	3	3.5	250
11	2014	2700	4	7	1200
05	2015	2800	4	5	0
11	2015	2500	4	1.3	200
11	2015	2000	3	4.2	150
11	2015	2000	3	5	150
08	2015	2800	4		350
	2013	2300	4	1.7	0
				3	200

Statistic	Most Recent Blower Door Test (Answer must be a single number e.g. 0, 25, 405)
Min Value	-
Max Value	-
Total Responses	-

42. Why was YOUR MOST RECENT blower door test conducted (select all that apply)?

#	Answer	Bar	Response	%
1	ENERGY STAR or other program compliance		41	39%
2	Florida Code compliance (testing completed for air leakage reduction performance path code credit or for envelope tightness demonstration)		9	9%
3	Homeowner/buyer request		27	26%
4	Builder or contractor standard practice		34	33%
5	Other, please describe		19	18%

Other, please describe
i use blower door test for homes that have high moisture content, checking the natural infiltration rate / and or / duct leakage (duct outside envelope) as a diagnostic tool, my MJ8 has data input for ach and blower door results
Westernization grant
Mostly older homes because of high energy usage!
Building built for testing and training
This builder was building his personal home and wanted to "make sure everything was done correctly" he had just recently changed insulation contractors because of the lack of quality the previous company was showing. He also wanted to make sure that his fireplace wasn't going to vent the gases back into his house like at his previous residence and request that the mechanical contractor added fresh air.
we constructed one miniature training home just for this purpose
to determine if building envelope had leaks
House humidity problems and duct sweating in attic.
Cost included all energy star testing as well as documentation and consultation costs
Just as a demo to see how the home performed
WAP inspection
As a high quality HVAC contractor we insist all components be within conditioned space. Our builders meet that requirement with sprayfoam. We test the sprayfoam with blower door and require foam sub to correct significant leaks
Architect Specified
More energy wasre happens in Florida due crappy designed duct systems. Well over 33% waste in HVAC electric in the typical home, some homes even worst. Builders screw over consumers who have no idea of a properly deisgned and installed HVAC system by not demanding proper air flow by Manual J room by room design.
replacement
Mechanical Engineer recommended the test to determine source of moisture entering the space.
LEED certification-
remodel on a 1973 home rehab project
Efficiency program requirement.

Statistic	Value
Min Value	1
Max Value	5
Total Responses	104

43. Considering only YOUR MOST RECENT whole-house mechanical ventilation system installation in a new Florida home (three stories or less), even if it was not typical of your work, please provide the following. (Answer must be a single number e.g. 0, 25, 405) Note: If the whole-house mechanical ventilation system was part of a larger scope of work, please estimate the cost to the builder for only the whole-house mechanical ventilation system.

Default - Most Recent Whole-House Mechanical Ventilation System Install (Answer must be a single number e.g. 0, 25, 405)					
Month (MM)	Year (YYYY)	Approximate conditioned area	Number of bedrooms	Approximate outside air flow (cfm)	Approximate cost to builder ($)
09	2015	3200	4	140	1600
9	2015	3200	3	200	3100
8	2015	1250	2		15000
7	2012	6000	4	8000	2500
10	2014	4800	3	850	2850
10	2015	5000	3	240	600
8	2015	1800	4	50	8,500.00
11	2015	2420	3	57	200
10	2014	1200	3	350	1000
0	0	0	0	0	0
10	2015	4500	4	200	2500
10	2015	2400	3	80	2000
04	2015	3500	4	125	1800
7	2015	2100	4	56	200
08	2013	4000	5		2500
11	2015	2031	4	80	500
4	24	2800	3	110	3500
10	2015	4000	5	160	2500
06	2015	1400	3	0	1200
10	2015	3000	4	60	350
11	2015	1500	3	45	100
11	2014	2000	3	0	9500
10	215	1500	3	45	150
10	2015	4000	4	6.8	180
8	2015	8000	5	175	5000
08	2015	1773	3	77	300
0	0	0	0	0	0
8	2015	1300	3		0
04	2015	2500	3		
10	2015	3000	4	50	350
08	2015	1850	3	2	3500
11	4	2700	4		880
11	2015	1942	4	45	380
06	2015	2798	4	.34	350
4	2015	5000	5	120	450
12	2012	900	3	50	5000
8	2014	4000	4	150	3500
11	2015	2000	3	3	300
11	2015	1400	3	23	1500
11	11	1960	4	120	1800
11	2015	3000	4	80	150
11	2015	1200	3		175
11	2015	2500	0	7000	25000
8	2015	2500	4	250	0
11	2015	950	2		15000
09	2015	3800	5	2000	1200
11	2015	1100	3	42	400
05	2015	3000	4	80	1800

6	2014	4000	4	1600	6500
11	2015	2200	3	200	1800
6	2015	3600	4	90	6500
04	2015	2000	3	50	150
10	15	8000	4	300	8000
03	2014	3800	5		2500
11	2015	7200	5	200	3000
0					
09	2015	2600	4	175	50.
04	2015	2000	3	5.4	100
03	2015	2700	3	110	450.00
0	0	0	0	0	0
10	2015	1650	3		
10	2015	2100	3	35	2000
11	2015	2000	3	60	200
01	2014	2300	3	120	2500
10	2015	2000	3	200	200
11	2014	2700	4		300
11	2015	3426	4	92	200
11	2015	2000	3	60	175
11	2015	2000	3	52	100
	2	2100	4	100	1900
	2013	2300	4	52	
	2014	20000	8	200	20000
					250

Statistic	Most Recent Whole-House Mechanical Ventilation System Install (Answer must be a single number e.g. 0, 25, 405)
Min Value	-
Max Value	-
Total Responses	-

44. What type of system was YOUR MOST RECENT whole-house mechanical ventilation system?

#	Answer	Bar	Response	%
1	Exhaust only (excluding occupant controlled kitchen and bathroom fans)		14	14%
2	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)		10	10%
3	Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)		18	18%
4	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)		27	27%
5	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)		18	18%
9	Other, please describe:		12	12%
	Total		99	

Other, please describe:
just bathroom exhaust and natural ventilation
none. it is stupid
A dehumidifier with a flex line and damper to the outside was installed as well as a bath fan timer to have an 80cfm bath ran fun for 15 minutes out of every hour. The advantage of the dehumidifier is that it can dehumidify the home home without bringing the outdoor compressor on and it can work seperatly to bring in outside air and dehumidify that air without bringing the unit on.
as noted in earlier answers.
NONE INSTALLED
Whole house dehumidifier
none done
n/a
Install outdoor air via dehumidifier to air handler
Outside air delivered to a dehumidifier to pretreat air before it is delivered to the air handler(s)
Dehumidifier with inside and/or outside air distribution
Continuous duty rated bath fan with label on the switch.

Statistic	Value
Min Value	1
Max Value	9
Mean	3.98
Variance	5.12
Standard Deviation	2.26
Total Responses	99

45. Why was YOUR MOST RECENT whole-house mechanical ventilation system included in this home (select all that apply)?

#	Answer	Bar	Response	%
1	ENERGY STAR or other program requires it		35	34%
2	Builder's request		20	19%
3	HVAC contractor or engineer's recommendation		23	22%
4	Homeowner/buyer's request		28	27%
5	Other		16	16%

Other
1
none
none, ever
By my recommendation
NONE
none done
Inspector
To meet building tightness limits. Ventilation failed and homewoner requested that it be removed. Resulted in Contractor purchasing a new HVAC system.
ASHRAE results
No vented attic
builder choice
as engineer of record
LEED Certification

Statistic	Value
Min Value	1
Max Value	5
Total Responses	103

46. Why was this specific whole-house mechanical ventilation system selected (select all that apply)?

#	Answer	Bar	Response	%
1	HVAC contractor's choice		32	32%
2	Builder's choice		37	37%
3	Homeowner/buyer's choice		26	26%
4	Price		12	12%
5	Other, please describe:		13	13%

Other, please describe:
Meet min. Requirement of building official
The builder/homeowner didn't want the "basic package" and liked the additional features that the dehumidifier provided for his home.
it works
NONE
Engineer's recommendation
Recommendation by Mechanical Engineer
none done
AHRAE 2013 required
Inspector
Based on home design it offered the fastest and simple to homeowner to understand
as engineer of record it is a tried and true method of delivering air to the space, dehumidifying the space and maintaining occupant comfort.
My choice, as I was the builder, homeowner, and system specifier
I recommended it to the as the most economical and safe way to meet ASHRAE 62.2

Statistic	Value
Min Value	1
Max Value	5
Total Responses	99

47. Was there any other additional HVAC cost ($) to the builder resulting from whole-house mechanical ventilation?

#	Answer	Bar	Response	%
1	No		55	54%
2	Yes		47	46%
	Total		102	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.46
Variance	0.25
Standard Deviation	0.50
Total Responses	102

48. If there was additional HVAC cost to the builder resulting from whole-house mechanical ventilation, please estimate the cost and describe the expense.

#	Answer	Bar	Response	%
1	Estimate cost ($) (Answer must be a single number e.g. 0, 25, 405)		36	97%
2	Describe the expense		26	70%

Estimate cost ($) (Answer must be a single number e.g. 0, 25, 405)	Describe the expense
500	Cosmetics
1500	Larger HVAC system, supplemental dehumidification.
500	
2500	
450	Cost of system
500	Insulation
2500	Caused delays in the construction, complications, and additional management time and cost.
500	Engineering design
1700	blower test and variable speed
2500	dehumidifier
1800	
500	Tonnage increase
450	COST OF UNIT / DUCT WORK
1000	
150	higher quality system
880	
350	additional vent into the soffit and and passive vent
5000	replace HVAC
3500	
200	ON/OFF override switch so the owner can turn it off to save money and have less moist air coming into the home, but hey the met the ASHRAE requirment.
300	Increased ac size
25000	
1800	Variable speed air handlers, thermidistat controls, intake duct and filtration along with control dampers
1800	Ducting & equipment.
400	
3500	Time and materials
4000	Cost of dehumidifier and installation.
1500	Automatic Fresh Air Dampers and Explaining them to the customers.
3000	Added duct, penetrations & equipment cost
5000	Equipment and labor
1500	
1000	
250	Retesting and correcting performance settings and measurements
5000	HVAC controls to operate dehumidification system in different modes, ie., fireplace on, kitchen hood on, elevated space humidity levels, turn off the system while unoccupied, etc.
1000	Increase A/C system size
175	
	extra sealing of envelope EnergyStar appliances

Statistic	Value
Min Value	1
Max Value	2
Total Responses	37

49. Any additional information or comments on YOUR MOST RECENT whole-house mechanical ventilation system?

Text Response
Again , You "Engineers" you have zero time in real world situations and competency have no idea what your doing. Do you remember sick building syndrome ?? Was it that long ago ? If you make a house so tight it will require automatic door closers on all doors just to keep them tight against the door seals. A positively pressured home will push air out of the chimney , window seals, door seals cracks around lighting fixtures, fans, exhaust etc. All your doing is wasting MORE ENERGY.
With the design conditions in our area, pre-conditioned mechanical ventilation is critical to a well designed, energy efficient home.
It was only useful during the cooler months between November and March in south Florida. It was a whole-house fan with a large CFM capacity to pull air through open windows and doors from outside to provide comfortable indoor conditions
This was and is a complete waste of client money
I would not recomend them to any client.
I have never installed one. they are stupid and counter intuitive to energy conservation.
The house preformes well The customer is able to maintain 75 indoor temperature with 45% relative humidity. Also when the fire place runs the propane smell does not come back into the house.
Totally ridicules additional requirement
we use Ultra-Aire dehumidifiers delivering the outdoor air into the return air duct systems, controlled with a Honeywell Prestige-IAQ thermostat that has the ability to control for temperature, humidity, and schedule ventilation with O.A. filtered and dehumidified prior to entering the home.
The proof is in application. For the last 10 years outside air brought into the home with a sealed attic directly to the air handler has worked very well.
NONE. Comment: affordable housing 1000ft2 - 2000ft2 will not recover the additional investment
Would like to see hot water recovery. and solar power A/C
have not installed any whole house systems
no
Cost reflects all energy star testing, reporting and consultation.
I will never do this again. I would rather walk away from a job than deal with the nightmare brought on by whole house ventilation in Florida
Exhaust fan method to meet ventilation should have no impact on hvac load or sizing
No
Will add significant costs to building
Cost of this change is not available to me at this time, getting pricing on testing for example was from 400 to 1000 dollars just for the test.
Energy Star should be geographical. Nobody wants to automatically draw humid air into their Florida Home. We told customers to turn them to the off position
used on every home!
Testing requirements not clear regarding method of setting controller and taking air flow measurements. Manufacturer's instructions also not clear.
We work primarily in the Atlantic coastal environment where extremely corrosive salt-laden air is present. Introducing air into the building reduces the life the equipment. If not extremely necessary, I would be a fan of not ventilating a house. Under normal occupancy and use, people tend to open and close doors frequently, and I wonder what the reason for outside air really is in residential. I agree that we should control uncontrolled infiltration by methods described in the code for building the envelop, however, the need for outside air ventilation in a residence should be evaluated in real life situations where normal people live in a house and come and go on a daily basis, multiple times. I can't imagine the build up of pollutants could happen that would warrant the need for dilution. (I do believe in dilution for commercial occupancies because pollutants do accumulate in that setting.)
We do not need Whole House Mechanical Ventilation in Florida

Statistic	Value
Total Responses	25

50. Do you anticipate that the Florida Code's blower door testing requirement and the associated whole-house air tightness requirement will be beneficial overall?

#	Answer	Bar	Response	%
1	Yes		128	45%
2	No		158	55%
	Total		286	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.55
Variance	0.25
Standard Deviation	0.50
Total Responses	286

51. Additional blower door test related comments:

Text Response
Code must be enforced equally to maintain integrity. There will be a lot of complaints upon implementing, but it will drastically improve comfort, energy savings, and quality of homes built to compliance.
I say no only because they are building these houses tight to meet buyers demands for lower power/energy bills. We already know most of these homes building components are working in that regard and many are in the 3.x ach50 already. All the testing is doing is verifying but at a added cost.
As written, the ACH cannot exceed 5. But, if it is less than 5, then outdoor air must be brought in. If that is the intent, then the Code should just mandate outdoor air intake. I do not believe that there will be any energy savings by tightening up buildings so much that there is no natural inflow of outdoor air in which case, then it needs to be brought in mechanically, thus increasing the energy usage for larger AC units, added mechanical fans and dampers. It seems to be a wash of any cost savings in addition to being an unnecessary task for an owner or builder to have done (blower door test).
blower door testing is needed, to help verify the builder has assembled an energy efficient home poor home owner has no clue about what a blower door test is, but a leaky home is expensive to operate and uncomfortable - to set a standard like "we are gonna build energy efficient homes in Florida by setting the standards (energy code)" BUT - we are not gonna verify the standards are not actually met? - blower door test verifies the envelope is intact, this envelope has too many layers and is only as good as the workmanship during assembly - all done by people - i can tell you many stories of envelopes so poor, indoor moisture content so high - all due to excessive infiltration, driven naturally almost year long in our region -
Florida certified meeting 2009 ICC but then proceeded to exclude blower door and duct blaster tests
Getting a 3rd party verifier keeps eveyone in gaged. Often evey one assumes the home is tight however often enough that is not the cases and highier energy usage and comfort issues are the result of poor engagement/ lack of building science understanding.
This test will not do anything for the safety of the occupants.
To achieve a test rating of no more than 5 ACH50 the structure would be prone to mold growth. by sealing the interior air barrier to the floor would promote moisture wicking from the concrete slab (curing process) into the wall board
it will cause too many delays and increase the cost of the homes
Testing has let all building trades know that they cannot hide mistakes during the building process, resulting in a better final product. "Will we be tested on this?" mentality.
i think it is government intrusion at its finest. most folks are stretching to buy a home and while i think it is a benefit to offer the service to the client it is not the government's purview to demand this of owners. it drives the costs and can put some people out of the market, lowers the ability of builders to keep costs where they can sell at a profit and still have buyers.
Don't want the houses that tight down here but having minimal outside air pressurization by some means would be beneficial (without increasing unit sizing, hopefully). HRV and ERV don't seem to have much value in a residential situation particularly since the FBC already is hinting that homes should be pressurized.
The Florida International residential building code has "required" blower door testing since 2010. The way contractors gert around this requirement is spelled out in the code with a note that follows after theblower door requirement: "if the building officials may visually see that the sealing has been performed then they will not require the blower door testing". As a certified home inspector I have recently inspected 3 new homes built in the last year - they were all built by different contractors. Each home was not sealed around the ceiling can lights or the HVAC boots. They also did not have the attic insulation consistently installed, some areas were missing insulation, others were not the required 12.75" deep. The supply ducting in the attic was not the required R-8. That these homes were not sealed in obvious places, who knows about all the covered areas that were required to be sealed?
Florida building code is a Rube Goldburg, it is a very complicated system to achieve a much simpler goal.
nonsence
A complete waste of money and time.
Today's construction standards are sufficient and I would expect blower door testing would not improve any energy efficiency or public safety issues.
If you keep adding additional testing and additional requirements to building than you drive the cost of building affordable housing for individuals that do not make the salaries that you do! How many people in your everyday activities that work extremely hard for just above minimum wage 40 hrs+ a week that cannot afford to feed their families and provide housing or shelter! Look around they work in grocery stores where you shop, fast food where you by your lunch, dinner, they cut your grass, they work hard but don't have anything to show but a paystub. Trying to save all the energy will not help them up out of poverty or living from paycheck to paycheck. Let's use common sense for a change!!!!!!!!!!!!!!!
A house would be better if icing was required, then leakage wouldn't be an issue. Another way of increasing energy Efficiency would be to increase the minimum SEER rating of an AC system or heat pump 16 SEER and a two stage compressor. Controlling the humidity in a Florida house is where comfort comes in. A two-stage system will pull more moisture out of a house and allow the homeowner to run the temperature at a higher temp with the same comfot as a house with higher humidity and a lower temperature.
That is the wrong question.... this is clearly not a question of science and therefore if it is true it must be false.
it is a waste of time and money and unnesesary
why would you need a tight house when you would have to do air changes?? who ever is coming up with these regulations needs to find work elsewhere.
Blower door testing really informs the builder and customer of the quality of home they are getting. Houses can look exactly the same but have extremely different infiltration rates. Blower door testing is a way to make sure that all of the sub contractors are performing the proper air sealing that is required by code. Just doing a visual inspection by the nacked eye is like how mechanical contractors used to use the "rule of thumb" to pick HVAC equipment size for house. It just doesn't work.
It doesn't make any sense to make a structure excessively tight and then introduce outside air back into the structure.
when there is a range to fall within... such as 4.2 to 5.4 for example, not just 5
Blower door test results are not consistent.
I think that builders will find a way to cheat the system, much like they are already doing in many homes in Alabama. It isn't hard to do, they can do one and past it, then keep changing the name, they can adjust the volume to decrease the ach number. I think many small mom and pop builders will end up paying the price while your large production builders will be allowed to get away with building poorly constructed homes. I think that allowing the builder or HVAC dealer who is working the job perform the testing will be a huge mistake and one that tricks the customer into believing he has this great home, when it may not be.
Blower door testing will be beneficial and will help eliminate leaks that will eventually introduce moisture. However, I don't think mandatory ventilation should be required unless there is a specific IAQ problem such as moisture or excessive CO2.
I think it is important for the home buyer to have an understanding of both air leakage and mechanical ventillation. Builders who adopt more energy effecient building practices should incorporate more feedback to their prospective clients about the home they may purchase and how it functions
This is another outrageous mandate that only increases costs and longer build times. If the building inspectors complete their jobs in a thorough manner, to make sure the home is sealed and insulated properly, and the A/C ducts are installed properly, then this test is not necessary.
as noted earlier, the homes are getting to tight and not allowed to breath properly causing the inability to control indoor humidity levels, causing mold problems in many cases.
it will verify house tightness and not have to guess

Blower door testing is representative only of the house the the exact time. Test will become routine and will only be attempting to do what's necessary to pass the test.

Scheduling and delays. Qualified contractors and/or raters

There will be cheaters, plus things will be modified by the owner or re-modelers, that have a great effect. Plus some Sealing Technics or materials won't last many years

Air leakage can account for up to 40% of energy loss for a building enclosure. Decreasing air leakage will significantly decrease energy consumption that is required to condition a home. Building that are more air tight limit occupants exposure to pollution and moisture laden air that promotes mold growth.

THEY WANT TO HAVE THE HOUSE TIGHT TO SAVE ENERGY, BUT TOO TIGHT YOU HAVE TO FORCE AIR INTO THE HOUSE TO PREVENT HAVING A SICK HOME. DO NOT SEE HOW THIS WILL BENEFIT ANYONE

The Energy Code requires certain levels and the homes need to be tested to certify compliance

No sufficient energy benefit to justify the cost and potential construction delays is foreseen.

Raises the bar for all builders improving their product for consumers.

Essential for energy efficiency, comfort, indoor air quality and to prevent mold in humid Florida.

Please define the goals and objectives before wasteful practices and standards are added to the building code. Blower door testing is trying to solve a problem that doesn't exist.

Testing will confirm that houses are built correctly and that HVAC performance will not be compromised by a house that is leakier than expected.

All Florida homes, especially referring to block construction, even under the previous code will have less than 3 ACH50. I've never tested one over the last nine years over 4 ACH50.

I have not been able to find any proof that the blower door test will make our homes any more efficient. It just adds additional non-value costs.

if the house is built so tight you have to use ventilation then you are bringing in the hot humid air the house was built to stop where is the savings

Very tight homes in the Florida climate are not neccessarily the best approach for safe and efficient construction.

another layer of testing/certification possible delays as learning curve of inspectors/inspections being climbed

Envelope leakage in FL is a waste of money to the homeowner and will become a health issue.

you don't know unless you test - establishing lower ACH' swill size equipemtn better. Eventuallu the home is heathier and has lower energy costs

The homes we build are tight enough, without needing to prove it.

Waste of time and money.

It will force builders and subs to think more about the quality of work they are installing. The thermal envelope is usually pretty tight on a new home. The greater problem is actually poorly installed insulation on walls that can only be seen with thermal imaging with a blower door running.

houses are being build to tight. thus the reason for this code!

Blower door test are great to determine air leakage and infiltration, especially in duck work and overall finish work. They can identify major deficiencies that are otherwise undetectable by the naked eye.

I think that blower door tests could be beneficial, but by pairing it with whole house ventilation, my response is "No, they do not benefit our home buyers". Blower door tests provide proof that our homes are tight, but we already know that they are tight due to building practices that have been added to the FBC over past years. I believe that if the FBC stated that HVAC register boxes are required to be caulked to the drywall, as it says for hi-hats, we would end up with the same result, but with out the extra additional costs for testing.

tighter home is energy savings and keeps outside air out that has high moisture reducing mold

Tightening houses will improve comfort and energy efficiency

When the builder follows the requirements of the Florida Building code, the house will comply with (pass) this envelope tightness requirement. The blower door test results provide proof to the consumer that the builder has, indeed, complied with the applicable parts of the code.

job creation, better building practices, less energy waste, third party verification for bulider

If you don't measure something, how can you manage it?

IDENTIFICATION AND TESTING IS A QUALITY ASSURANCE STEP THAT IS REQUIRED TO PROVIDE THE CONSUMER WITH CONFIDENCE IN THE ABILITY OF THE BUILDER AND THE TRADES HE EMPLOYS. WITHOUT THIS THERE IS ONLY THE END RESULT OF POSSIBLE FAILURE AFTER THE FACT WITH THE BURDEN ON THE CONSUMER. THIS NEEDS TO END.

It will take time and require attention to details on the installation of components to achieve a well sealed house...along with good design.

We add blower door requirements to all our projects in the specifications

Since the new codes that make these house more tight, has sprung many more problems.

From past experience from 2005-2007 on 3 story townhouse (230 built with foam insulation in attic) and conducting these test every 20 units (approx) and getting 94% + seal, we had to equip the AHU units with additional equipment to have 40% air intake. The problem encountered having to keep the A/C on at all time. We encountered complaints from new owners who go out of town for a few days ...leaving the A/C off to save electricity...only to come back to their home and find spores on their ceiling and walls resulting in a plethora of complaints. Florida's humid air intake does not solve the problem for air tightness.

Quit adding more expense to home buyers..

Demand Manual J designs room by room for ALL homes!

Lobbyists are constantly causing useless expenses for homeowners.

At the risk of stating the obvious, the purpose of the blower door test and whole house mechanical ventilation are directly at odds with one another. Requiring both is a classic case of over-regulation. Comparable results can be achieved by requiring proper sealing of the building envelope. If different results are desired, passive options would be the preferred avenue. If the current code requirements are suitable then increased enforcement by building officials is an option that could be considered.

I believe it is a waste of the contractors money, do to the fact that the energy code requires the dwellings to be so tight.

This is a waste of time and money , a quote from a company We were going to use: "We can adjust the test parameters to get the results needed" So Just like the Load calculations requirements can be adjusted, this will simply add to the cost and the time required without acually affecting the outcome of the building efficiency

Without oversight I'm not sure how the test results can be trusted.

home owner consumer not ready or does not understand the impact of this

It's just the State asking for money! It's Bull crap.

consider the more efficient home will cost the HOME OWNER less during the life of the home.

Prevent Infilitration. Add testing because contractors will do as little as they can at one site to move onto the next one. Make this a requirement, test it and certify it.

It has been well documented over the past 30 years in research conducted and by Building America through the US Department of Energy that building a tight envelope is an advantage in energy conservation and the air quality in projects across America.
It would be good to have all homes built to improve their efficiency.
Qualifications of Tester?
On one hand, if the contractor is responsible and competent, they will have to adhere to the infiltration checklist in FBC-EC table R402.4.1.1. I would imagine that this should be a tight envelop where a blower door test would most likely pass. So what does the expensive blower door test do? It proves that the contractor performed everything on the list or not. Wasn't he supposed to do that anyway? The building department, although not responsible for the construction, inspects from the list. Are they doing their job if the test fails? If the test fails, and the contractor has to fix the problems (that he should have taken care of originally), would another test be necessary? If so, who would pay for it? All in all, I'm not seeing the benefit of passing costs for expensive test, most likely the result of shoddy construction on to the owner. Perhaps this is negligence on the part of the contractor and should be brought to the State's attention.
The House are so tight now That they are talking about whole House Ventilation ??
Yes, because as the energy code requirements get more and more stringent, the homes become tighter and tighter.
If a home is built to code and the various inspections are completed along the way to ensure that all material is compliant with code and installed property; then, there should be no need to test.
See additional whole-house mechanical ventilation related comments.
Builder was doing tests but refused to supply homeowners with written results, assured them verbally results were stellar
Quality assurance in new home product should be important.
This will help put better homes on the general market
Do not make a rule or code you cannot enforce. This will be such a rule. It has good intentions and can have positive effects. However, it will be almost impossible to implement, enforce, and monitor long term. The simpler solution is requiring all ducts to be installed within the conditioned envelope. This will eliminate the need for a blower door test and is enforceable.
The goals of the new code are understandable. The infiltration of hot, humid air can be severly detrimental to the health of occupants and quality of construction. The additional requirements for whole-house ventilation are also logical -- however, it seems silly in a way to assume that any test (to several decimals) can possibly result in the exact number to avoid a whole-house ventilation system, and for that reason I believe the whole-house ventilation should be required for all new projects that are required to reach the air tight construction.
House should not be air tight
Need the infrastructure to do and not set up yet. Everyone scrambling.
It is good to test the houses and locate the leaks for repair.

Statistic	Value
Total Responses	93

52. Do you anticipate that the Florida Code's whole-house mechanical ventilation requirement will be beneficial overall?

#	Answer	Bar	Response	%
1	Yes		109	39%
2	No		170	61%
	Total		279	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.61
Variance	0.24
Standard Deviation	0.49
Total Responses	279

53. Additional whole-house mechanical ventilation related comments:

Text Response
Building tighter and more energy efficient homes requires mechanical ventilation to prevent negative results in home comfort.
Watering down chemicals brought in by the homeowners isnt going to help much or at all. Florida's climate is hot and wet and it is making issues. From a health standpoint it would be better to educate homeowners on not brinkng in voc laden furniture, flooring, etc. Filling a house with toxic junk is the issue and watering it down via fresh air isnt the answer.
See my comments written in the Blower Door test question above.
This one is going to be tough, often I have seen the wrong size ducts for this and equipment.
the humidity that the fresh air vent brings in could cause mold problems if the systems don't have humidity control. the ones that do have humidity control will run longer in order to get the humidity out so you have to have a damper installed to cut off the fresh air duct until the cycle for humidity control is complete
Only if the ACH50 is below 3.0. (My opinion only)
see comment above government overreach
Generally a waste of money. Toilet/kitchen/dryer exhaust can provide that ventilation and has for years without any significant issues. Why fix something that isn't broken.
We stop houses from leaking air so we can put mechanical leakage into it for the purpose of job creation and increased cost to the consumer.
Do not like the idea of bringing in unwanted irritants, noxious odors, smoke etc. from the outdoor air.
industry driven
They worked well in the homes built a long time ago before a/c. Energy conservation is a life style. I am a Florida GC (CGC 012036) since 1977 AND owned Gale insulaion in Alachua County from 1979 untill we went public in `94. I am building affordable homes in my area now. You can do away with all computer programs both residential and comericial. Just have minimum standards, in my opinion.
BUT! Builder/buyer awareness of proper mechanical ventilation systems is not sufficient. Choosing the least expensive code compliance method will create more public health safety. the amounts of fresh air required through a tight home will create a science experiment inside most airhandlers
We just came out of the worst economic down turn for the construction industry every and you want to burden the residential builder even more! Reallyyyyy!!! if you think that money grows on trees and that everyone will just joyously run out and pick some and give it to the builders just because they have no other good thing to think about. WHAT FANTASY LAND DO YOU PEOPLE LIVE IN. GET YOUR ASS OUT OF YOUR IVORY TOWERS AND LOOK AT THE IMPACT YOU ARE HAVING ON THE PEOPLE AND YOU WILL BE DOING A BETTER SERVICE TO ALL
The standard sealing requirement are enough to satisfy building tightness. There is no need for blower door testing.
Counter intuitive to energy conservation. I don't see any advantage to it whatsoever.
I have plenty of experience with mechanical ventilation from the houses I have worked on. When you use an HVAC contractor or engineer that knows how to design the houses properly for our climate zone. You will have no problems. Most of the home owners that I get to educate about ventilation request it. Florida is not the only state that is in Climate zone 2 we face the same problems as other South East Costal areas do. If they can make mechanical ventilation work for them. We can also make it work for us. Just as I have with my customers.
Increase the run time of variable speed Condensor Units to help reduce interior humidity. Don't bring in humid outside air.
the introduction of additional outdoor air just creates more issues to deal with
The basic philosophy of mechanical engineering is to simplify a system. There are ways to test positive pressurization without a full blower door test.
ASHRAE standards that mechanical ventilation when a home is at 5 or 4 is way to strict. If a Florida customer builds the home exactly to those standards they will have moisture homes, with higher utility costs and be uncomfortable. Forcing someone to have make-up air with homes that are this close to 5 does not create a healthy home. HVAC dealers should be made to get better certifications and view a home on a case by case bases to determine if the home needs the make-up ventilation. If they stand by their work, then this should be no problem, and if it goes bad, then the HVAC dealer should be held responsible.
Blower door testing will be beneficial and will help eliminate leaks that will eventually introduce moisture. However, I don't think mandatory ventilation should be required unless there is a specific IAQ problem such as moisture or excessive CO2.
Mechanical ventillation for tight homes should be a requirement.
Why would we continue to make the new homes tighter in nature and more energy efficient, then take a huge step in reverse by bringing in unconditioned air from the outside and reduce the energy effeciency we have strived to acheive?
the introduction of hot humid air to our homes will be more of a negative than any benifit
If properly completed, the indoor air quality would be better.
Adding humidity and moisture to the conditioned environment.
They will be turned off to save energy, plus they will not be repaired or replaced when they fail.
SAME REASON AS STATED IN THE LAST COMMENT. IF IT IS CONDITIONED VENTILATION IT WILL BENEFIT THE HOME AND HOMEOWNER, EXCEPT THERE WILL BE NO ENERGY SAVINGS INVOLVED DUE TO THE EXPENSE AND OPERATION OF THE ERV
Will bring inevitable humidity problems in low and medium priced production homes. Except for the high end custom homes that have sufficient budgets to cover the cost of variable speed AC equipment and/or Dehumidifiers, the problem of Outside Air moisture being introduced into the homes will not be addressed and will cause serious property and health hazards.
Some foamed houses do not have adequate fresh air and it is affecting the health of the homeowners.
As a builder of Energy Star and FGBC Cetified GREEN homes for almost twenty years I've seen what works and what doesn't. Additional mechanical ventillation is not necessary and would only be an issue if air leakage is measured and controlled more than it is now. Homeowners are not building scientists and will not understand these systems well enough to monitor their proper performance.
Mechanical ventilation will ensure indoor air quality and that fresh air is coming into the house for residents.
The homes are so tight, they need to have ventilation air.
I have not been able to find any proof that mechanical ventilation will make our homes any more efficient. It just adds additional non-value costs.
THERE ARE BUILDERS THAT ARE NOT GOING TO COMPLY WITH THE NEW STANDARDS OR TAKE SHORT CUTS, THERE IS TOO MANY UNANSWERED QUESTIONS, WHEN WE ASK A QUESTION TO 3 DIFFERENT PEOPLE WE GET 3 DIFFERENT OPINIONS AND IDEAS.
only when you build a house that can't breath otherwise no
Very tight homes in the Florida climate are not neccessarily the best approach for safe and efficient construction.

see comments above

I think that the ventilation requirements are cross purposes with the air tightness, which is a glaroing commentary of the lack of agreement within the industry. We need better data on all the above to include costs analysys and impact to restricting access to affordable housing for the future generations.

We are making the house too tight and then we want to bring in outside air in a regulated manner? We understand the thought process from a committee meeting standpoint, but let's look at it from a reality standpoint of cost, time, and the fact that homeowners don't want it. In a person home, I would be disconnecting the outside air fan.

Eventually when all of the bugs and missconceptions are worked out. Initially I see lots of pushback because people and especially builders and HVAC don't see the need.

Bringing warm moist air into a tight home is a bad idea. Over time, the moisture will accumulate in the home and begin to mildew IF the home is not designed to condition that moisture.

You are asking for trouble when ever you introduce outside air into a hot, humid climate. HVAC systems need to work much harder. For the most part it is completely unnecessary as most people spend the majority of their time outside of the home.

I personally don't feel that whole house ventilation is needed if a home is built to 4-5 air changes per hour. I believe that the threshold should be 3 ACH before a whole house ventilation system is needed. I think that it opens us up to have problems with the indoor environment of our homes, because if it is not done improperly, then problems will definitely occur. And, by making this a code requirement, we're asking a lot of under qualified contractors to install systems that they are not familiar with.

No, why bring fresh air into home from the humid outside in Florida, Allow an option to do spot exhaust and dehumidify the exiting air. Only worry about fresh air if the oxygen count gets lower than 15% or so.

Mech ventilation code doesn't consider actual operation / usage of home - all the already-occuring leaks into even a tight home such as by standard exhaust ductwork, doors opened periodically, etc.

Following the requirements of the building code results in a house with less tha .02 natural air changes per hour. With no added, controlled, mechanical ventilation, the house will eventually develop moisture problems. It is solely the builder's responsibility to know and follow the code, and hence to know the house requires ventilation.

education is key component if every home gets it, regardless of method, the homeowner can decide to use or not letting consumers know there is a system in place to help them ventilate if needed

Introducing warm, moist air into a conditioned home is not good science. The results speak for themselves. 2 years of installing the mechanical ventilation has resulted in several call backs to address mildew/mold growing throughout the homes in question. Anyone with any common sense knew this would happen, but the engineers and experts knew better...They'd have common sense if they had to build something instead of talk about it.

Having a tight home is good. But it being too tight that it can't breath isn't. Might as well bring in the ventilation in a manageable quantity, location and be able to filter it.

VENTILATION IS NECESSARY FOR A HEALTHY INDOOR ENVIRONMENT. REDUCTION OF CARBON DIOXIDE BUILD UP AND POSSIBLE RADON BUILDUP DUE TO NON VENTILATION OF SPACES CAN BE UNHEALTHY. FRESH AIR IS NECESSARY FOR A HEALTHY ENVIRONMENT AND IN FLORIDA IT NEEDS TO BE CONDITIONED AIR DUE TO OUR CLIMATIC TEMPERATURES.

It won't, however, be beneficial to the State as a whole, until older homes are required to comply.

These codes off no benefit at all. The mandates of the 15 degree design criteria do not provide a realistic outcome. If it's 95 degrees outside are you willing to sit in a home at 80 degrees?

Not a good idea for a high humidity climate

Don't know. Many Florida residents don't ever open windows

At the risk of stating the obvious, the purpose of the blower door test and whole house mechanical ventilation are directly at odds with one another. Requiring both is a classic case of over-regulation. Comparable results can be achieved by requiring proper sealing of the building envelope. If different results are desired, passive options would be the preferred avenue. If the current code requirements are suitable then increased enforcement by building officials is an option that could be considered.

Not in favor of more codes or laws

I think the negatives outweigh the positives. We will have more mold and moisture issues with decrease in equipment life. South Florida is very humid and hot most of the year. Equipment looks good when the job is complete, but when parts start to fail down the road the homeowner won't fix due to cost and the service company will bypass.

Direct outdoor air into the air handler (when running) would help keep the dwelling at a positive pressure.

just going to add to the costs and not going to add to energy efficiency ....so why do it.

I see no reason to add this requirement when we have doors and operable windows (provided they meet the required open spaces for natural ventilation). The idea of forcing hot and humid air into our cool spaces during the summer leads me to believe that condensation will be a factor when this air comes into contact with the cool spaces and this will provide an environment suitable for mold growth. The forced air must be treated and residential equipment is not designed for this. The additional front end costs of the equipment will affect the consumer, and the increased energy costs to treat this air will have a negative impact on the environment. The idea of forcing cold air into the warm spaces in the winter will increase energy costs for the additional electric heat, natural gas, or heat pump operation and the consumption of these fuels will have a negative impact on the environment.

here in south Florida, humidity concerns and proper control to prevent mold. High cost difficult to explain and justify cost.

Air quality is important to the home's occupants. Air exchange especially in tighter houses can be an issue for the health of the house. The induction of fresh makeup air insures that both the house and the homeowners will stay healthy.

Tough job in Florida to balance fresh air vs. humidity. ERV is best but too expensive for general use.

Because Florida is humid, outside air, if not brought into the building properly, could cause disastrous problems, especially with mold. I think the judgment of the need for outside air should be left to the engineer. Normal occupancy and use of normal homes logically will tell us that people come and go through doors many times a day. This would seem to provide enough ventilation to dilute any pollutants inside. In addition, bringing in unnecessary warm, humid outside air is extremely expensive to dehumidify properly and could lead to mold, something I don't think is a benefit to homeowners. This should be left a choice to the owners/designers, not a mandate.

To bring in 90 degree Hot Air with 90% Humidity in the Summer sounds crazy to me

yes, because of the tightness of the homes today, it is preventing the natural infiltration of fresh air in and trapping old, contaminated air to be re-breathed by inhabitants

BUT- IT MUST BE A JOINT EFFORT OF THE BUILDING SCIENCE PEOPLE, THE MEP ENGINEERS, AND FIELD EXPERIENCED QUALITY ORIENTED HVAC AND GC TYPE INDIVIDUALS. CHANGE IS HARD, IF NOT IMPOSSIBLE FOR MOST PEOPLE, ESPECIALLY THE TYPICAL BONEHEAD IN THE CONSTRUCTION INDUSTRY AND THIS IS PERHAPS THE BIGGEST PROBLEM. PLUS THE RESISTANT "HOW CHEAP CAN I BUILD IT AND HOW MUCH MONEY CAN I MAKE AND TO HELL WITH THE DURABILITY, COMFORT AND EFFICIENCY OF THE FINISHED PRODUCT....NOT MY PROBLEM!!"

Most won't be installed properly.

On Homes with a low ACH50

Code requires exhaust fans in the kitchen and all baths...this coupled with the fact that people go in and out of there homes should provide fresh air into the home as opposed to having to bring in unconditioned, moisture latent air internally. Perhaps a HVAC system thermostat with air quality measurements and humidity level measurements would circumvent the need for additional mechanical ventilation because it could call the system on as levels indicated the need as opposed to making it run when it's not needed.

The problem in Florida is humidity. Requiring more outdoor air to be brought in increases indoor humidity, and increases energy costs. The only reason to require outdoor air systems is because requirements for tighter construction reduce infiltration. In a heating climate it makes sense. In Florida with the example, concrete block with a stucco finish is already a pretty good air barrier.

Further study required in high humidity areas (Miami-Dade, Broward, Monroe, etc...) dehumidification (essentially small AC) needed with heat recovery in tight house due to required air changes. Running large AC to cool, and small AC to dehumidify when large AC is off means an AC is running nearly 24/7 in summer. This may result in a trickle of energy savings - overshadowed by flood of upfront cost Without effective dehumidification, buyers will spend more to buy new houses with mold and mildew. We should not rush to enact law which substitutes one problem for another.
May or may not be real world beneficial depending on individual circumstances, academically beneficial overall.
Healthier houses better IAQ
I have seen the misuse of whole-house mechanical ventilation. The designers do not fully understand its purpose and the builders want it cheap. These are two ingredients in the recipe for disaster. I perform a lot of building evaluations. I have seen more harm than good. I also see that ventilation in our warm, humid climate can be highly overrated. Many buildings function quite well without all the ventilation deemed necessary by the code. One prime example is a church. The church requires a tremendous amount of outside air for a minimal use facility. The cost of the equipment to provide this large quantity of outside air is expensive. I have found churches work very well without all the outside air.
See above, I combined the remarks.
Depends on the house. Some feel smaller houses don't need.
Mandating ventilation in a hot humid climate is dangerous. To bring in the amount of fresh air specified by ASHRAE 62.2, that air MUST be conditioned. Residential hvac system cannot process that amount of latent load. Therefore the air will have to be pre treated by a commercial grade EVR's. But, the exiting air will be too hot and too humid to distribute in the home. The discharge will have to be processed by the hvac system. Or the fresh air will have to be dried in a commercial grade dehumidifier and then processed by the hvac system. The type of ERV or dehumidifier required would add $3,000 to the cost of a new home. Additionally, the extra sensible load may require a larger capacity hvac system which would add another $1,500 to the cost of a new home.
If done correctly

Statistic	Value
Total Responses	81

Appendix F:
Residential Construction Survey Multiple Choice Questions Cross Tabulated by Profession

Final - Industry Survey Concernin...

Final - Industry Survey Concerning New Florida Residential Construction - 11-5-noon

Cross Tabulation

861 Responses

Add Filters

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
Part 1 - About Your Business Have you been involved in the construction of new Florida homes ov...	Yes	248 91.5%	161 82.6%	39 73.6%	87 95.6%	16 80.0%	20 90.9%	29 76.3%	34 91.9%	86 66.7%	558 82.8%
	No	23 8.5%	34 17.4%	14 26.4%	4 4.4%	4 20.0%	2 9.1%	9 23.7%	3 8.1%	43 33.3%	116 17.2%
	Total	271 100.0%	195 100.0%	53 100.0%	91 100.0%	20 100.0%	22 100.0%	38 100.0%	37 100.0%	129 100.0%	674 100.0%
Would any additional air sealing be necessary to reach the required blower door test result of no...	Yes, in many or all cases.	71 38.0%	52 35.4%	15 37.5%	24 29.3%	4 25.0%	5 26.3%	6 18.8%	6 22.2%	30 36.6%	170 35.4%
	No, unlikely for most homes	51 27.3%	45 30.6%	10 25.0%	49 59.8%	8 50.0%	13 68.4%	15 46.9%	7 25.9%	24 29.3%	154 32.1%
	I don't know	65 34.8%	50 34.0%	15 37.5%	9 11.0%	4 25.0%	1 5.3%	11 34.4%	14 51.9%	28 34.1%	156 32.5%
	Total	187 100.0%	147 100.0%	40 100.0%	82 100.0%	16 100.0%	19 100.0%	32 100.0%	27 100.0%	82 100.0%	480 100.0%
BLOWER DOOR TESTING Estimate the cost to builder for conducting a blower door test and all associ... - For the EXAMPLE HOUSE (Answer must be a single number e.g. 0, 25, 405)	Estimated cost to builder for testing, associated reporting, and all communications ($)	107 100.0%	92 100.0%	21 95.5%	68 100.0%	12 100.0%	15 100.0%	21 100.0%	13 100.0%	45 100.0%	293 99.7%
	On-site time needed to conduct test (hours)	107 100.0%	92 100.0%	22 100.0%	68 100.0%	12 100.0%	15 100.0%	21 100.0%	13 100.0%	45 100.0%	294 100.0%
	How long, if at all, would normal site activity need to stop for testing (hours)	106 99.1%	89 96.7%	20 90.9%	68 100.0%	12 100.0%	15 100.0%	21 100.0%	13 100.0%	45 100.0%	288 98.0%
	Fee for retesting, if necessary ($)	100 93.5%	92 100.0%	19 86.4%	66 97.1%	11 91.7%	15 100.0%	20 95.2%	13 100.0%	44 97.8%	283 96.3%
	Total	107 100.0%	92 100.0%	22 100.0%	68 100.0%	12 100.0%	15 100.0%	21 100.0%	13 100.0%	45 100.0%	294 100.0%
Are there any factors that would warrant a substantial increase or	Increase	57 96.6%	58 95.1%	9 81.8%	44 93.6%	10 100.0%	7 87.5%	11 91.7%	6 85.7%	25 92.6%	170 94.4%

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
decrease in your cost estimate...	Decrease	12 20.3%	20 32.8%	6 54.5%	33 70.2%	5 50.0%	4 50.0%	5 41.7%	1 14.3%	14 51.9%	69 38.3%
	Total	59 100.0%	61 100.0%	11 100.0%	47 100.0%	10 100.0%	8 100.0%	12 100.0%	7 100.0%	27 100.0%	180 100.0%
Estimate when the builder could expect to receive the testing results:	The same or next business day	40 30.3%	29 25.7%	7 28.0%	38 55.1%	5 35.7%	10 62.5%	13 56.5%	7 35.0%	18 31.6%	120 34.1%
	2 or 3 business days	38 28.8%	40 35.4%	10 40.0%	20 29.0%	5 35.7%	6 37.5%	5 21.7%	7 35.0%	14 24.6%	106 30.1%
	4 or 5 business days	21 15.9%	18 15.9%	3 12.0%	6 8.7%	3 21.4%	0 0.0%	1 4.3%	1 5.0%	10 17.5%	47 13.4%
	More than 5 business days	7 5.3%	6 5.3%	0 0.0%	2 2.9%	0 0.0%	0 0.0%	2 8.7%	0 0.0%	6 10.5%	19 5.4%
	I don't know	26 19.7%	20 17.7%	5 20.0%	3 4.3%	1 7.1%	0 0.0%	2 8.7%	5 25.0%	9 15.8%	60 17.0%
	Total	132 100.0%	113 100.0%	25 100.0%	69 100.0%	14 100.0%	16 100.0%	23 100.0%	20 100.0%	57 100.0%	352 100.0%
WHOLE HOUSE MECHANICAL VENTILATION SYSTEM What type of 2014 Florida Code compliant whole-house me...	Exhaust only (excluding occupant controlled kitchen and bathroom fans)	26 27.1%	16 16.0%	6 33.3%	11 16.9%	1 9.1%	2 13.3%	2 8.7%	2 11.1%	8 17.8%	59 20.5%
	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	11 11.5%	8 8.0%	3 16.7%	2 3.1%	1 9.1%	2 13.3%	1 4.3%	3 16.7%	3 6.7%	24 8.3%
	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	38 39.6%	25 25.0%	5 27.8%	26 40.0%	5 45.5%	4 26.7%	10 43.5%	10 55.6%	20 44.4%	106 36.8%
	HRV (heat recover ventilator) or ERV (energy recovery ventilator)	7 7.3%	33 33.0%	1 5.6%	16 24.6%	2 18.2%	5 33.3%	5 21.7%	1 5.6%	6 13.3%	54 18.8%
	Other, please describe	14 14.6%	18 18.0%	3 16.7%	10 15.4%	2 18.2%	2 13.3%	5 21.7%	2 11.1%	8 17.8%	45 15.6%
	Total	96 100.0%	100 100.0%	18 100.0%	65 100.0%	11 100.0%	15 100.0%	23 100.0%	18 100.0%	45 100.0%	288 100.0%
Are there any factors that would likely warrant a substantial increase or decrease in your cost e...	Decrease	4 9.5%	14 33.3%	3 50.0%	16 76.2%	3 60.0%	2 66.7%	7 58.3%	1 20.0%	9 56.3%	35 31.8%
	Increase	42 100.0%	39 92.9%	5 83.3%	18 85.7%	5 100.0%	2 66.7%	8 66.7%	4 80.0%	12 75.0%	101 91.8%

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
	Total	42 100.0%	42 100.0%	6 100.0%	21 100.0%	5 100.0%	3 100.0%	12 100.0%	5 100.0%	16 100.0%	110 100.0%
Would you expect the selection or characteristics of the air conditioning and heating equipment t...	Yes	68 64.8%	77 72.0%	9 40.9%	35 53.0%	6 54.5%	9 60.0%	16 69.6%	10 55.6%	20 42.6%	183 59.4%
	No	24 22.9%	26 24.3%	7 31.8%	26 39.4%	4 36.4%	6 40.0%	7 30.4%	5 27.8%	16 34.0%	87 28.2%
	I don't know	13 12.4%	4 3.7%	6 27.3%	5 7.6%	1 9.1%	0 0.0%	0 0.0%	3 16.7%	11 23.4%	38 12.3%
	Total	105 100.0%	107 100.0%	22 100.0%	66 100.0%	11 100.0%	15 100.0%	23 100.0%	18 100.0%	47 100.0%	308 100.0%
If you expect the selection or characteristics of the air conditioning and heating equipment to c...	Estimate cost ($) (Answer must be a single number e.g. 0, 25, 405)	57 96.6%	58 96.7%	7 100.0%	28 87.5%	5 100.0%	9 100.0%	10 90.9%	5 83.3%	17 89.5%	143 95.3%
	Describe the expense	35 59.3%	48 80.0%	4 57.1%	26 81.3%	5 100.0%	7 77.8%	8 72.7%	4 66.7%	15 78.9%	104 69.3%
	Total	59 100.0%	60 100.0%	7 100.0%	32 100.0%	5 100.0%	9 100.0%	11 100.0%	6 100.0%	19 100.0%	150 100.0%
If blower door testing is required in the FUTURE, who would you expect to offer blower door testi...	Home Energy Raters	53 48.6%	55 53.9%	13 56.5%	67 95.7%	9 75.0%	13 81.3%	10 47.6%	8 44.4%	30 58.8%	186 58.9%
	Utilities	16 14.7%	12 11.8%	2 8.7%	9 12.9%	1 8.3%	3 18.8%	2 9.5%	3 16.7%	11 21.6%	41 13.0%
	Weatherization professionals	23 21.1%	22 21.6%	7 30.4%	20 28.6%	8 66.7%	9 56.3%	5 23.8%	4 22.2%	16 31.4%	75 23.7%
	HVAC contractors	62 56.9%	69 67.6%	13 56.5%	33 47.1%	5 41.7%	9 56.3%	10 47.6%	15 83.3%	29 56.9%	180 57.0%
	Insulation contractors	27 24.8%	21 20.6%	7 30.4%	12 17.1%	3 25.0%	6 37.5%	2 9.5%	5 27.8%	8 15.7%	64 20.3%
	Energy Code calculation providers	23 21.1%	29 28.4%	4 17.4%	14 20.0%	4 33.3%	5 31.3%	5 23.8%	3 16.7%	10 19.6%	69 21.8%
	Builders will test their own homes	15 13.8%	18 17.6%	5 21.7%	5 7.1%	1 8.3%	5 31.3%	4 19.0%	5 27.8%	9 17.6%	44 13.9%
	Other, please describe:	11 10.1%	6 5.9%	5 21.7%	17 24.3%	3 25.0%	4 25.0%	4 19.0%	2 11.1%	13 25.5%	44 13.9%
	I don't know	4 3.7%	6 5.9%	1 4.3%	1 1.4%	0 0.0%	0 0.0%	3 14.3%	2 11.1%	5 9.8%	18 5.7%
	Total	109 100.0%	102 100.0%	23 100.0%	70 100.0%	12 100.0%	16 100.0%	21 100.0%	18 100.0%	51 100.0%	316 100.0%
If blower door testing is required in the FUTURE, do you or your company	Yes	32 30.2%	53 52.0%	13 56.5%	57 82.6%	11 91.7%	15 93.8%	6 28.6%	8 50.0%	20 42.6%	141 45.8%

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
intend to conduct or off...	No	74 69.8%	49 48.0%	10 43.5%	12 17.4%	1 8.3%	1 6.3%	15 71.4%	8 50.0%	27 57.4%	167 54.2%
	Total	106 100.0%	102 100.0%	23 100.0%	69 100.0%	12 100.0%	16 100.0%	21 100.0%	16 100.0%	47 100.0%	308 100.0%
Have you or your company already acquired training to conduct blower door testing?	Yes	16 50.0%	30 56.6%	11 84.6%	54 94.7%	10 90.9%	15 100.0%	5 83.3%	5 62.5%	15 75.0%	99 70.2%
	No	16 50.0%	23 43.4%	2 15.4%	3 5.3%	1 9.1%	0 0.0%	1 16.7%	3 37.5%	5 25.0%	42 29.8%
	Total	32 100.0%	53 100.0%	13 100.0%	57 100.0%	11 100.0%	15 100.0%	6 100.0%	8 100.0%	20 100.0%	141 100.0%
Which of the following best describes the type of training you received to conduct blower door te...	Self study	2 12.5%	2 6.7%	0 0.0%	0 0.0%	0 0.0%	1 6.7%	2 40.0%	0 0.0%	1 7.1%	5 5.1%
	Certification program	10 62.5%	26 86.7%	10 90.9%	50 92.6%	9 90.0%	14 93.3%	2 40.0%	2 40.0%	10 71.4%	81 82.7%
	Industry association training	4 25.0%	2 6.7%	1 9.1%	2 3.7%	1 10.0%	0 0.0%	1 20.0%	3 60.0%	2 14.3%	10 10.2%
	Other	0 0.0%	0 0.0%	0 0.0%	2 3.7%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 7.1%	2 2.0%
	Total	16 100.0%	30 100.0%	11 100.0%	54 100.0%	10 100.0%	15 100.0%	5 100.0%	5 100.0%	14 100.0%	98 100.0%
What resources would you need to double the number of blower door tests annually (select all that...	Additional training	10 33.3%	21 39.6%	2 16.7%	9 15.8%	3 27.3%	0 0.0%	0 0.0%	5 62.5%	2 11.1%	39 28.3%
	Additional personned	16 53.3%	41 77.4%	7 58.3%	35 61.4%	9 81.8%	12 80.0%	6 100.0%	5 62.5%	12 66.7%	92 66.7%
	Additional equipment	17 56.7%	38 71.7%	9 75.0%	30 52.6%	8 72.7%	9 60.0%	3 50.0%	5 62.5%	7 38.9%	86 62.3%
	Other	1 3.3%	3 5.7%	0 0.0%	2 3.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	2 11.1%	7 5.1%
	Nothing	6 20.0%	3 5.7%	1 8.3%	10 17.5%	1 9.1%	2 13.3%	0 0.0%	1 12.5%	3 16.7%	17 12.3%
	I don't know	2 6.7%	1 1.9%	2 16.7%	2 3.5%	0 0.0%	0 0.0%	0 0.0%	1 12.5%	4 22.2%	8 5.8%
	Total	30 100.0%	53 100.0%	12 100.0%	57 100.0%	11 100.0%	15 100.0%	6 100.0%	8 100.0%	18 100.0%	138 100.0%
If whole-house mechanical ventilation is required in the FUTURE, will you or your company be invo...	Yes	62 56.4%	76 73.8%	10 43.5%	48 69.6%	10 83.3%	11 68.8%	18 85.7%	9 56.3%	30 57.7%	197 62.1%
	No	48 43.6%	27 26.2%	13 56.5%	21 30.4%	2 16.7%	5 31.3%	3 14.3%	7 43.8%	22 42.3%	120 37.9%
	Total	110 100.0%	103 100.0%	23 100.0%	69 100.0%	12 100.0%	16 100.0%	21 100.0%	16 100.0%	52 100.0%	317 100.0%

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co...	Exhaust only (excluding occupant controlled kitchen and bathroom fans)	20 32.8%	16 21.3%	3 30.0%	14 29.2%	2 20.0%	4 36.4%	3 16.7%	1 11.1%	6 20.0%	49 25.1%
	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	14 23.0%	10 13.3%	1 10.0%	6 12.5%	1 10.0%	2 18.2%	1 5.6%	3 33.3%	4 13.3%	32 16.4%
	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	26 42.6%	38 50.7%	5 50.0%	27 56.3%	7 70.0%	6 54.5%	12 66.7%	4 44.4%	16 53.3%	97 49.7%
	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	11 18.0%	35 46.7%	3 30.0%	20 41.7%	6 60.0%	6 54.5%	5 27.8%	2 22.2%	10 33.3%	64 32.8%
	Other, please describe	7 11.5%	14 18.7%	3 30.0%	7 14.6%	2 20.0%	3 27.3%	7 38.9%	1 11.1%	4 13.3%	29 14.9%
	I don't know	7 11.5%	3 4.0%	1 10.0%	2 4.2%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	4 13.3%	15 7.7%
	Total	61 100.0%	75 100.0%	10 100.0%	48 100.0%	10 100.0%	11 100.0%	18 100.0%	9 100.0%	30 100.0%	195 100.0%
Are there any types of whole-house mechanical ventilation system you would not specify to comply...	Yes, please describe which system(s) you would not specify and why:	10 18.2%	30 50.0%	3 37.5%	25 62.5%	7 77.8%	4 40.0%	14 82.4%	3 33.3%	13 44.8%	71 41.8%
	No	14 25.5%	16 26.7%	3 37.5%	10 25.0%	2 22.2%	6 60.0%	1 5.9%	2 22.2%	2 6.9%	38 22.4%
	I don't know	31 56.4%	14 23.3%	2 25.0%	5 12.5%	0 0.0%	0 0.0%	2 11.8%	4 44.4%	14 48.3%	61 35.9%
	Total	55 100.0%	60 100.0%	8 100.0%	40 100.0%	9 100.0%	10 100.0%	17 100.0%	9 100.0%	29 100.0%	170 100.0%
Please complete the table below for the blower door tests you have conducted or had conducted for... - Tested for ENERGY STAR or other program certification	% of Total Blower Door Tests Conducted (%)	22 100.0%	13 92.9%	5 100.0%	40 100.0%	5 100.0%	4 100.0%	5 100.0%	2 100.0%	9 100.0%	70 98.6%
	Approximate Average ACH50?	16 72.7%	8 57.1%	4 80.0%	35 87.5%	5 100.0%	4 100.0%	4 80.0%	2 100.0%	8 88.9%	56 78.9%
	Approximate Average Cost to Builder for Blower Door Testing* ($)	20 90.9%	11 78.6%	4 80.0%	37 92.5%	5 100.0%	4 100.0%	4 80.0%	2 100.0%	8 88.9%	64 90.1%
	Total	22 100.0%	14 100.0%	5 100.0%	40 100.0%	5 100.0%	4 100.0%	5 100.0%	2 100.0%	9 100.0%	71 100.0%
Please complete the table below for the blower door tests you have	% of Total Blower Door Tests Conducted (%)	15 100.0%	11 91.7%	5 100.0%	30 100.0%	6 100.0%	5 100.0%	4 100.0%	1 100.0%	8 100.0%	52 98.1%

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
conducted or had conducted for... - Tested for optional Florida Energy Code (performance path credit or envelope tightness demonstration)	Approximate Average ACH50?	10 66.7%	8 66.7%	4 80.0%	25 83.3%	5 83.3%	5 100.0%	2 50.0%	1 100.0%	6 75.0%	41 77.4%
	Approximate Average Cost to Builder for Blower Door Testing* ($)	11 73.3%	10 83.3%	4 80.0%	26 86.7%	5 83.3%	5 100.0%	2 50.0%	1 100.0%	6 75.0%	44 83.0%
	Total	15 100.0%	12 100.0%	5 100.0%	30 100.0%	6 100.0%	5 100.0%	4 100.0%	1 100.0%	8 100.0%	53 100.0%
Please complete the table below for the blower door tests you have conducted or had conducted for... - All others	% of Total Blower Door Tests Conducted (%)	10 100.0%	7 87.5%	5 71.4%	27 100.0%	5 83.3%	5 83.3%	5 83.3%	0 0.0%	5 100.0%	41 95.3%
	Approximate Average ACH50?	10 100.0%	6 75.0%	5 71.4%	26 96.3%	5 83.3%	5 83.3%	4 66.7%	0 0.0%	5 100.0%	38 88.4%
	Approximate Average Cost to Builder for Blower Door Testing* ($)	10 100.0%	8 100.0%	7 100.0%	27 100.0%	6 100.0%	6 100.0%	5 83.3%	0 0.0%	5 100.0%	42 97.7%
	Total	10 100.0%	8 100.0%	7 100.0%	27 100.0%	6 100.0%	6 100.0%	6 100.0%	0 100.0%	5 100.0%	43 100.0%
Based on past experience, what would you expect the ACH50 to be in a CODE-MINIMUM new Florida hom...	ACH50 < 3	3 10.3%	3 10.7%	0 0.0%	4 7.8%	1 10.0%	1 9.1%	1 14.3%	0 0.0%	3 16.7%	13 12.1%
	ACH50 between 3.1 and 6	9 31.0%	11 39.3%	4 40.0%	30 58.8%	2 20.0%	6 54.5%	2 28.6%	2 66.7%	5 27.8%	47 43.9%
	ACH50 between 6.1 and 9	6 20.7%	2 7.1%	2 20.0%	4 7.8%	3 30.0%	1 9.1%	0 0.0%	0 0.0%	2 11.1%	11 10.3%
	ACH50 > 9	1 3.4%	1 3.6%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	2 11.1%	2 1.9%
	I don’t know	6 20.7%	8 28.6%	2 20.0%	0 0.0%	1 10.0%	1 9.1%	1 14.3%	1 33.3%	2 11.1%	18 16.8%
	Comments	4 13.8%	3 10.7%	2 20.0%	13 25.5%	3 30.0%	2 18.2%	3 42.9%	0 0.0%	4 22.2%	16 15.0%
	Total	29 100.0%	28 100.0%	10 100.0%	51 100.0%	10 100.0%	11 100.0%	7 100.0%	3 100.0%	18 100.0%	107 100.0%
In the PAST TWO YEARS, have you ever had a building delay of three or more days due to unavailabi...	Yes	7 22.6%	9 34.6%	1 10.0%	4 8.2%	3 33.3%	1 9.1%	0 0.0%	0 0.0%	3 16.7%	18 17.0%
	No	24 77.4%	17 65.4%	9 90.0%	45 91.8%	6 66.7%	10 90.9%	7 100.0%	3 100.0%	15 83.3%	88 83.0%
	Total	31 100.0%	26 100.0%	10 100.0%	49 100.0%	9 100.0%	11 100.0%	7 100.0%	3 100.0%	18 100.0%	106 100.0%
Please use the table below to indicate the type(s) of whole-house mechanical	% of Total Installs (%)	21 100.0%	20 100.0%	2 100.0%	19 100.0%	5 100.0%	3 100.0%	4 100.0%	1 100.0%	6 100.0%	55 100.0%

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
ventilation systems... - Exhaust only (excluding occupant controlled kitchen and bathroom fans)	Approx. Average Cost to Builder Including Installation ($)	12 57.1%	10 50.0%	1 50.0%	12 63.2%	4 80.0%	2 66.7%	0 0.0%	0 0.0%	3 50.0%	31 56.4%
	Total	21 100.0%	20 100.0%	2 100.0%	19 100.0%	5 100.0%	3 100.0%	4 100.0%	1 100.0%	6 100.0%	55 100.0%
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	% of Total Installs (%)	14 100.0%	11 100.0%	2 100.0%	12 100.0%	3 100.0%	3 100.0%	3 100.0%	1 100.0%	4 100.0%	35 100.0%
	Approx. Average Cost to Builder Including Installation ($)	8 57.1%	6 54.5%	1 50.0%	7 58.3%	2 66.7%	2 66.7%	0 0.0%	1 100.0%	1 25.0%	18 51.4%
	Total	14 100.0%	11 100.0%	2 100.0%	12 100.0%	3 100.0%	3 100.0%	3 100.0%	1 100.0%	4 100.0%	35 100.0%
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)	% of Total Installs (%)	16 100.0%	19 100.0%	2 100.0%	21 100.0%	5 100.0%	3 100.0%	6 100.0%	1 100.0%	6 100.0%	51 100.0%
	Approx. Average Cost to Builder Including Installation ($)	8 50.0%	14 73.7%	1 50.0%	15 71.4%	4 80.0%	2 66.7%	4 66.7%	0 0.0%	2 33.3%	31 60.8%
	Total	16 100.0%	19 100.0%	2 100.0%	21 100.0%	5 100.0%	3 100.0%	6 100.0%	1 100.0%	6 100.0%	51 100.0%
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	% of Total Installs (%)	20 95.2%	18 100.0%	1 100.0%	18 100.0%	5 100.0%	3 100.0%	5 100.0%	2 100.0%	7 100.0%	57 98.3%
	Approx. Average Cost to Builder Including Installation ($)	13 61.9%	10 55.6%	0 0.0%	12 66.7%	4 80.0%	2 66.7%	1 20.0%	1 50.0%	3 42.9%	34 58.6%
	Total	21 100.0%	18 100.0%	1 100.0%	18 100.0%	5 100.0%	3 100.0%	5 100.0%	2 100.0%	7 100.0%	58 100.0%
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	% of Total Installs (%)	19 95.0%	21 100.0%	1 100.0%	20 100.0%	6 100.0%	3 100.0%	4 100.0%	2 100.0%	8 100.0%	54 98.2%
	Approx. Average Cost to Builder Including Installation ($)	11 55.0%	12 57.1%	0 0.0%	12 60.0%	5 83.3%	2 66.7%	1 25.0%	1 50.0%	4 50.0%	31 56.4%
	Total	20 100.0%	21 100.0%	1 100.0%	20 100.0%	6 100.0%	3 100.0%	4 100.0%	2 100.0%	8 100.0%	55 100.0%
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - Other, please describe:	% of Total Installs (%)	3 100.0%	8 100.0%	2 100.0%	5 100.0%	0 0.0%	0 0.0%	3 100.0%	0 0.0%	0 0.0%	14 100.0%
	Approx. Average Cost to Builder Including Installation ($)	1 33.3%	7 87.5%	1 50.0%	4 80.0%	0 0.0%	0 0.0%	2 66.7%	0 0.0%	0 0.0%	10 71.4%

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
	Total	3 100.0%	8 100.0%	2 100.0%	5 100.0%	0 100.0%	0 100.0%	3 100.0%	0 100.0%	0 100.0%	14 100.0%
In the PAST TWO YEARS, have you ever had a building delay of three days or more related to whole...	Yes	15 27.8%	10 23.3%	1 25.0%	5 15.2%	3 42.9%	0 0.0%	0 0.0%	0 0.0%	5 33.3%	29 22.5%
	No	39 72.2%	33 76.7%	3 75.0%	28 84.8%	4 57.1%	4 100.0%	8 100.0%	4 100.0%	10 66.7%	100 77.5%
	Total	54 100.0%	43 100.0%	4 100.0%	33 100.0%	7 100.0%	4 100.0%	8 100.0%	4 100.0%	15 100.0%	129 100.0%
Why were the whole-house mechanical ventilation systems installed (select all that apply)?	ENERGY STAR or other program requires it	19 37.3%	21 42.9%	2 40.0%	24 72.7%	3 42.9%	2 40.0%	4 44.4%	3 60.0%	6 40.0%	62 46.3%
	Builder standard practice	20 39.2%	16 32.7%	1 20.0%	9 27.3%	2 28.6%	2 40.0%	3 33.3%	3 60.0%	4 26.7%	42 31.3%
	Homeowner/buyer request	11 21.6%	25 51.0%	3 60.0%	18 54.5%	2 28.6%	4 80.0%	3 33.3%	1 20.0%	7 46.7%	51 38.1%
	Other, please describe	16 31.4%	11 22.4%	2 40.0%	5 15.2%	3 42.9%	1 20.0%	5 55.6%	1 20.0%	4 26.7%	32 23.9%
	Total	51 100.0%	49 100.0%	5 100.0%	33 100.0%	7 100.0%	5 100.0%	9 100.0%	5 100.0%	15 100.0%	134 100.0%
Considering only YOUR MOST RECENT blower door test in a new Florida home (three stories or less),... - Most Recent Blower Door Test (Answer must be a single number e.g. 0, 25, 405)	Month (MM)	23 100.0%	17 100.0%	9 100.0%	46 97.9%	7 100.0%	9 100.0%	6 100.0%	1 100.0%	13 92.9%	83 97.6%
	Year (YYYY)	23 100.0%	17 100.0%	9 100.0%	47 100.0%	7 100.0%	9 100.0%	6 100.0%	1 100.0%	13 92.9%	84 98.8%
	Approximate conditioned Area (ft2)	23 100.0%	17 100.0%	9 100.0%	47 100.0%	7 100.0%	9 100.0%	6 100.0%	1 100.0%	13 92.9%	84 98.8%
	Number of bedrooms	23 100.0%	17 100.0%	9 100.0%	47 100.0%	7 100.0%	9 100.0%	6 100.0%	1 100.0%	13 92.9%	84 98.8%
	Approximate ACH50 test result	18 78.3%	14 82.4%	9 100.0%	46 97.9%	7 100.0%	9 100.0%	6 100.0%	1 100.0%	12 85.7%	77 90.6%
	Approximate cost to builder ($)	23 100.0%	17 100.0%	9 100.0%	47 100.0%	7 100.0%	9 100.0%	6 100.0%	1 100.0%	13 92.9%	84 98.8%
	Total	23 100.0%	17 100.0%	9 100.0%	47 100.0%	7 100.0%	9 100.0%	6 100.0%	1 100.0%	14 100.0%	85 100.0%
Why was YOUR MOST RECENT blower door test conducted (select all that apply)?	ENERGY STAR or other program compliance	15 53.6%	5 22.7%	3 33.3%	22 43.1%	2 25.0%	1 10.0%	2 33.3%	2 50.0%	3 16.7%	41 39.8%
	Florida Code compliance (testing completed for air leakage reduction performance path code credit or for envelope tightness demonstration)	2 7.1%	1 4.5%	2 22.2%	4 7.8%	0 0.0%	0 0.0%	0 0.0%	1 25.0%	2 11.1%	9 8.7%

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
	Homeowner/buyer request	3 10.7%	9 40.9%	3 33.3%	17 33.3%	1 12.5%	5 50.0%	2 33.3%	1 25.0%	6 33.3%	27 26.2%
	Builder or contractor standard practice	9 32.1%	5 22.7%	3 33.3%	14 27.5%	3 37.5%	3 30.0%	1 16.7%	3 75.0%	6 33.3%	33 32.0%
	Other, please describe	4 14.3%	6 27.3%	2 22.2%	8 15.7%	2 25.0%	3 30.0%	3 50.0%	0 0.0%	7 38.9%	19 18.4%
	Total	28 100.0%	22 100.0%	9 100.0%	51 100.0%	8 100.0%	10 100.0%	6 100.0%	4 100.0%	18 100.0%	103 100.0%
Considering only YOUR MOST RECENT whole-house mechanical ventilation system installation in a new... - Most Recent Whole-House Mechanical Ventilation System Install (Answer must be a single number e.g. 0, 25, 405)	Month (MM)	25 100.0%	21 95.5%	2 100.0%	25 92.6%	5 100.0%	3 100.0%	7 87.5%	1 100.0%	9 90.0%	69 94.5%
	Year (YYYY)	24 96.0%	22 100.0%	2 100.0%	27 100.0%	5 100.0%	3 100.0%	8 100.0%	1 100.0%	9 90.0%	71 97.3%
	Approximate conditioned area	24 96.0%	22 100.0%	2 100.0%	27 100.0%	5 100.0%	3 100.0%	8 100.0%	1 100.0%	9 90.0%	71 97.3%
	Number of bedrooms	24 96.0%	22 100.0%	2 100.0%	27 100.0%	5 100.0%	3 100.0%	8 100.0%	1 100.0%	9 90.0%	71 97.3%
	Approximate outside air flow (cfm)	18 72.0%	22 100.0%	2 100.0%	25 92.6%	5 100.0%	3 100.0%	8 100.0%	1 100.0%	6 60.0%	61 83.6%
	Approximate cost to builder ($)	24 96.0%	22 100.0%	2 100.0%	25 92.6%	5 100.0%	3 100.0%	8 100.0%	1 100.0%	9 90.0%	69 94.5%
	Total	25 100.0%	22 100.0%	2 100.0%	27 100.0%	5 100.0%	3 100.0%	8 100.0%	1 100.0%	10 100.0%	73 100.0%
What type of system was YOUR MOST RECENT whole-house mechanical ventilation system?	Exhaust only (excluding occupant controlled kitchen and bathroom fans)	5 13.2%	3 9.7%	1 33.3%	6 19.4%	1 16.7%	0 0.0%	0 0.0%	0 0.0%	1 8.3%	14 14.1%
	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	5 13.2%	2 6.5%	0 0.0%	1 3.2%	0 0.0%	0 0.0%	1 12.5%	1 33.3%	1 8.3%	10 10.1%
	Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)	7 18.4%	5 16.1%	0 0.0%	5 16.1%	1 16.7%	0 0.0%	2 25.0%	0 0.0%	4 33.3%	18 18.2%
	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	9 23.7%	9 29.0%	0 0.0%	10 32.3%	1 16.7%	2 50.0%	0 0.0%	0 0.0%	1 8.3%	27 27.3%

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		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	7 18.4%	9 29.0%	1 33.3%	5 16.1%	3 50.0%	2 50.0%	0 0.0%	1 33.3%	5 41.7%	18 18.2%
	Other, please describe:	5 13.2%	3 9.7%	1 33.3%	4 12.9%	0 0.0%	0 0.0%	5 62.5%	1 33.3%	0 0.0%	12 12.1%
	Total	38 100.0%	31 100.0%	3 100.0%	31 100.0%	6 100.0%	4 100.0%	8 100.0%	3 100.0%	12 100.0%	99 100.0%
Why was YOUR MOST RECENT whole-house mechanical ventilation system included in this home (select...	ENERGY STAR or other program requires it	11 26.2%	6 19.4%	1 33.3%	17 54.8%	3 50.0%	1 25.0%	2 25.0%	1 33.3%	3 25.0%	35 34.0%
	Builder's request	10 23.8%	9 29.0%	1 33.3%	4 12.9%	1 16.7%	1 25.0%	3 37.5%	0 0.0%	0 0.0%	20 19.4%
	HVAC contractor or engineer's recommendation	7 16.7%	9 29.0%	0 0.0%	5 16.1%	0 0.0%	1 25.0%	3 37.5%	1 33.3%	4 33.3%	23 22.3%
	Homeowner/buyer's request	11 26.2%	11 35.5%	1 33.3%	10 32.3%	1 16.7%	2 50.0%	3 37.5%	0 0.0%	5 41.7%	28 27.2%
	Other	10 23.8%	4 12.9%	0 0.0%	2 6.5%	2 33.3%	0 0.0%	4 50.0%	1 33.3%	2 16.7%	16 15.5%
	Total	42 100.0%	31 100.0%	3 100.0%	31 100.0%	6 100.0%	4 100.0%	8 100.0%	3 100.0%	12 100.0%	103 100.0%
Why was this specific whole-house mechanical ventilation system selected (select all that apply)?	HVAC contractor's choice	10 25.0%	16 55.2%	1 33.3%	11 35.5%	1 16.7%	3 75.0%	1 12.5%	0 0.0%	2 16.7%	32 32.3%
	Builder's choice	17 42.5%	7 24.1%	0 0.0%	15 48.4%	2 33.3%	2 50.0%	3 37.5%	1 33.3%	5 41.7%	37 37.4%
	Homeowner/buyer's choice	12 30.0%	7 24.1%	1 33.3%	8 25.8%	2 33.3%	0 0.0%	2 25.0%	1 33.3%	6 50.0%	26 26.3%
	Price	2 5.0%	3 10.3%	0 0.0%	5 16.1%	2 33.3%	1 25.0%	0 0.0%	1 33.3%	1 8.3%	12 12.1%
	Other, please describe:	7 17.5%	1 3.4%	1 33.3%	3 9.7%	2 33.3%	0 0.0%	6 75.0%	0 0.0%	2 16.7%	13 13.1%
	Total	40 100.0%	29 100.0%	3 100.0%	31 100.0%	6 100.0%	4 100.0%	8 100.0%	3 100.0%	12 100.0%	99 100.0%
Was there any other additional HVAC cost ($) to the builder resulting from whole-house mechanical...	No	21 53.8%	15 46.9%	1 50.0%	19 63.3%	3 50.0%	3 75.0%	5 62.5%	2 66.7%	5 41.7%	55 53.9%
	Yes	18 46.2%	17 53.1%	1 50.0%	11 36.7%	3 50.0%	1 25.0%	3 37.5%	1 33.3%	7 58.3%	47 46.1%
	Total	39 100.0%	32 100.0%	2 100.0%	30 100.0%	6 100.0%	4 100.0%	8 100.0%	3 100.0%	12 100.0%	102 100.0%
If there was additional HVAC cost to the builder resulting from whole-house mechanical ventilatio...	Estimate cost ($) (Answer must be a single number e.g. 0, 25, 405)	16 100.0%	13 100.0%	1 100.0%	8 100.0%	3 100.0%	1 100.0%	3 100.0%	0 0.0%	5 83.3%	36 97.3%

		Are you a (an) (select all that apply):									
		Home Builder	HVAC Contractor	Trade Contractor Other than HVAC, please describe:	Certified Home Energy Rater	Weatherization Industry Professional	Other Blower Door Testing Provider	Mechanical Engineer	Code Official	Other, please describe	Total
	Describe the expense	9 56.3%	9 69.2%	0 0.0%	7 87.5%	3 100.0%	1 100.0%	3 100.0%	0 0.0%	5 83.3%	26 70.3%
	Total	16 100.0%	13 100.0%	1 100.0%	8 100.0%	3 100.0%	1 100.0%	3 100.0%	0 100.0%	6 100.0%	37 100.0%
Do you anticipate that the Florida Code's blower door testing requirement and the associated whol...	Yes	30 31.6%	25 29.1%	13 68.4%	50 76.9%	9 81.8%	10 83.3%	9 47.4%	10 62.5%	25 51.0%	127 44.7%
	No	65 68.4%	61 70.9%	6 31.6%	15 23.1%	2 18.2%	2 16.7%	10 52.6%	6 37.5%	24 49.0%	157 55.3%
	Total	95 100.0%	86 100.0%	19 100.0%	65 100.0%	11 100.0%	12 100.0%	19 100.0%	16 100.0%	49 100.0%	284 100.0%
Do you anticipate that the Florida Code's whole-house mechanical ventilation requirement will be...	Yes	24 25.8%	25 29.1%	9 50.0%	38 62.3%	3 30.0%	6 50.0%	8 42.1%	11 68.8%	21 43.8%	108 39.0%
	No	69 74.2%	61 70.9%	9 50.0%	23 37.7%	7 70.0%	6 50.0%	11 57.9%	5 31.3%	27 56.3%	169 61.0%
	Total	93 100.0%	86 100.0%	18 100.0%	61 100.0%	10 100.0%	12 100.0%	19 100.0%	16 100.0%	48 100.0%	277 100.0%

		Are you a (an) (select all that apply):
Part 1 - About Your Business Have you been involved in the construction of new Florida homes ov...	Chi Square	56.1*
	Degrees of Freedom	8
	p-value	0.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
Would any additional air sealing be necessary to reach the required blower door test result of no...	Chi Square	60.1
	Degrees of Freedom	16
	p-value	0.0

		Are you a (an) (select all that apply):

BLOWER DOOR TESTING Estimate the cost to builder for conducting a blower door test and all associ... - For the EXAMPLE HOUSE (Answer must be a single number e.g. 0, 25, 405)	Chi Square	0.8
	Degrees of Freedom	24
	p-value	1.0

		Are you a (an) (select all that apply):
Are there any factors that would warrant a substantial increase or decrease in your cost estimate...	Chi Square	22.1*
	Degrees of Freedom	8
	p-value	0.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
Estimate when the builder could expect to receive the testing results:	Chi Square	52.0*
	Degrees of Freedom	32
	p-value	0.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
WHOLE HOUSE MECHANICAL VENTILATION SYSTEM What type of 2014 Florida Code compliant whole-house me...	Chi Square	49.8*
	Degrees of Freedom	32
	p-value	0.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
Are there any factors that would likely warrant a substantial increase or decrease in your cost e...	Chi Square	30.6*
	Degrees of Freedom	8
	p-value	0.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
Would you expect the selection or characteristics of the air conditioning and heating equipment t...	Chi Square	35.4*
	Degrees of Freedom	16
	p-value	0.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
If you expect the selection or characteristics of the air conditioning and heating equipment to c...	Chi Square	4.1*
	Degrees of Freedom	8
	p-value	0.8

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
If blower door testing is required in the FUTURE, who would you expect to offer blower door testi...	Chi Square	104.6*
	Degrees of Freedom	64
	p-value	0.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
If blower door testing is required in the FUTURE, do you or your company intend to conduct or off...	Chi Square	78.6
	Degrees of Freedom	8
	p-value	0.0

		Are you a (an) (select all that apply):
Have you or your company already acquired training to conduct blower door testing?	Chi Square	38.2*
	Degrees of Freedom	8
	p-value	0.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Which of the following best describes the type of training you received to conduct blower door te...	Chi Square	47.2*
	Degrees of Freedom	24
	p-value	0.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
What resources would you need to double the number of blower door tests annually (select all that...	Chi Square	51.0*
	Degrees of Freedom	40
	p-value	0.1

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
If whole-house mechanical ventilation is required in the FUTURE, will you or your company be invo...	Chi Square	20.7*
	Degrees of Freedom	8
	p-value	0.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to co...	Chi Square	46.9*
	Degrees of Freedom	40
	p-value	0.2

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Are there any types of whole-house mechanical ventilation system you would not specify to comply...	Chi Square	61.8*
	Degrees of Freedom	16
	p-value	0.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Please complete the table below for the blower door tests you have conducted or had conducted for... - Tested for ENERGY STAR or other program certification	Chi Square	2.6*
	Degrees of Freedom	16
	p-value	1.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Please complete the table below for the blower door tests you have conducted or had conducted for... - Tested for optional Florida Energy Code (performance path credit or envelope tightness demonstration)	Chi Square	2.5*
	Degrees of Freedom	16
	p-value	1.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Please complete the table below for the blower door tests you have conducted or had conducted for... - All others	Chi Square	2.2*
	Degrees of Freedom	16
	p-value	1.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Based on past experience, what would you expect the ACH50 to be in a CODE-MINIMUM new Florida hom...	Chi Square	53.7*
	Degrees of Freedom	40
	p-value	0.1

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
In the PAST TWO YEARS,	Chi Square	13.7*

have you ever had a building delay of three or more days due to unavailabi...	Degrees of Freedom	8
	p-value	0.1

*Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - Exhaust only (excluding occupant controlled kitchen and bathroom fans)	Chi Square	3.7*
	Degrees of Freedom	8
	p-value	0.9

*Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	Chi Square	3.0*
	Degrees of Freedom	8
	p-value	0.9

*Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - Supply only: runtime without control (ventilation air distributed via AC air handler, and only when air handler is on)	Chi Square	3.0*
	Degrees of Freedom	8
	p-value	0.9

*Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Please use the table below to indicate the type(s) of	Chi Square	2.9*

whole-house mechanical ventilation systems... - Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)		
	Degrees of Freedom	8
	p-value	0.9

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Chi Square	2.3*
	Degrees of Freedom	8
	p-value	1.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems... - Other, please describe:	Chi Square	1.1*
	Degrees of Freedom	8
	p-value	1.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
In the PAST TWO YEARS, have you ever had a building delay of three days or more related to whole...	Chi Square	9.2*
	Degrees of Freedom	8
	p-value	0.3

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
Why were the whole-house mechanical ventilation systems installed (select all that apply)?	Chi Square	29.3*
	Degrees of Freedom	24
	p-value	0.2

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		Are you a (an) (select all that apply):
Considering only YOUR MOST RECENT blower door test in a new Florida home (three stories or less),... - Most Recent Blower Door Test (Answer must be a single number e.g. 0, 25, 405)	Chi Square	1.5*
	Degrees of Freedom	40
	p-value	1.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Why was YOUR MOST RECENT blower door test conducted (select all that apply)?	Chi Square	37.3*
	Degrees of Freedom	32
	p-value	0.2

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Considering only YOUR MOST RECENT whole-house mechanical ventilation system installation in a new... - Most Recent Whole-House Mechanical Ventilation System Install (Answer must be a single number e.g. 0, 25, 405)	Chi Square	3.3*
	Degrees of Freedom	40
	p-value	1.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
What type of system was YOUR MOST RECENT whole-house mechanical ventilation system?	Chi Square	55.4*
	Degrees of Freedom	40
	p-value	0.1

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Why was YOUR MOST	Chi Square	37.2*

RECENT whole-house mechanical ventilation system included in this home (select...	Degrees of Freedom	32
	p-value	0.2

*Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Why was this specific whole-house mechanical ventilation system selected (select all that apply)?	Chi Square	56.8*
	Degrees of Freedom	32
	p-value	0.0

*Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Was there any other additional HVAC cost ($) to the builder resulting from whole-house mechanical...	Chi Square	3.6*
	Degrees of Freedom	8
	p-value	0.9

*Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
If there was additional HVAC cost to the builder resulting from whole-house mechanical ventilatio...	Chi Square	2.7*
	Degrees of Freedom	8
	p-value	1.0

*Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):
Do you anticipate that the Florida Code’s blower door testing requirement and the associated whol...	Chi Square	63.0*
	Degrees of Freedom	8
	p-value	0.0

*Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		Are you a (an) (select all that apply):

Do you anticipate that the Florida Code's whole-house mechanical ventilation requirement will be...	Chi Square	32.6*
	Degrees of Freedom	8
	p-value	0.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

Appendix G:

Residential Construction Survey Comments

Note: Authors have sorted comments by categories they created based on user comments for easier understanding.

Sorted "Other" comments for Question #3: Are you a (an) (select all that apply):

	Architect
1	Architect
2	Architect
3	Architect
4	Architect
5	Architect
6	Architect
7	Architect
8	Architect
9	Architect
10	Architect
11	Architect
12	Architect
13	ARCHITECT
14	ARCHITECT
15	Architect
16	Architect
17	Architect
18	Architect
19	Architect
20	Architect
21	Architect
22	Architect
23	Architect
24	architect
25	Architect
26	Architect
27	Architect
28	Architect
29	Architect
30	Architect
31	Architect
32	architect
33	Architect
34	Architect
35	Architect
36	architect
37	Architect
38	Architect
39	Architect
40	Architect
41	Architect
42	architect
43	architect
44	Architect
45	Architect . I work for G.L. Homes
46	Architect and Florida Certified home Inspector
47	Architect specializing in multifamily
48	Architect, General Contractor
49	architect/engineer
50	Architect/Engineering Firm

51 Architectural and Engineering Firm

General Contractor

1 Certified General contractor
2 Certified General Contractor
3 Certified general Contractor
4 Certified General Contractor / Specializing in renovation and remodeling
5 Certified General Contractor Buildings
6 Certified Residential Energy Auditor
7 CGC
8 CGC I primarily engage in concrete work.
9 CGC specializing in remodel projects
10 Florida State Certified General Contractor
11 GC
12 GC CONTRACTOR
13 GC, we do both residential and commercial work.
14 CGC & CCC / General & Roofing
15 General contractor
16 General Contractor
17 General contractor
18 General Contractor
19 General Contractor
20 general contractor
21 General Contractor
22 general contractor
23 General Contractor
24 General Contractor
25 General Contractor
26 GENERAL CONTRACTOR
27 General contractor
28 General Contractor / Marine Specialty Contractor / Home Inspector / Mold Assessor / Mold Remediator / Commercial Bu
Residential Building Inspector / Commercial Plumbing Inspector / Residential Plumbing Inspector / Coastal Constructoion
29 General Contractor doing Assisted living & other multi family facilities
30 general contractor, I do doors, windows ,Bathroom and Kitchen remodels
31 Homebuilder with a certified general contractor license. / A BPI QCI certified inspector. / An advisor to most of Florida fo
including fielding calls from state and DOE representative.

HVAC Contractor

1 Ac contractor
2 HVAC contractor also.
3 HVAC Designer
4 I am a HVAC contractor but most importanly I am a HVAC commissioning authorty / Commissioning agent and mechanic

Other

1 Building Diagnostician / Certified Thermographer / Building's Research (energy/moisture)
2 Building Enclosure Consultant/Engineer
3 Building materials supplier
4 Commercial contractor
5 consultant
6 Consultant - Business Owner

7 Consulting Engineer
8 Design Engineer
9 Energy Code Specialist
10 Utility / Energy Efficiency Inspector, Energy Advisor
11 Engineer
12 Engineer, Building Scientist
13 Home Designer
14 Home Designer
15 Home remolder
16 Instructor
17 LEED/FGBC/NGBS third-party green home verifier
18 Manufacturer of spray foam insulation products
19 Manufacturers Rep
20 Manufacturer's rep for building materials.
21 Marketing/Key Account Representative with Choctawhatchee Electric Cooperative, a distribution electric cooperative.
22 mostly commercial last two years
23 p e
24 Professional Engineer
25 Property Insurer
26 Realtor, and home investor and remodeler.
27 Registered Architect
28 Research
29 research in NGO
30 Researcher & Educator
31 residential construction manager, cgc1516843
32 residential contractor building additions
33 Residential Designer
34 Residential energy auditor
35 Structural engineer
36 structural engineer
37 structural engineer, energy code forms, house plans
38 Utility Employee doing energy efficient building program
39 Utility Employee.
40 Utility-Energy Services-was a rater-but certification expired and have not renewed as of yet.
41 Window & Door Contractor
42 Test and Balance / As the codes have not required test and balance for residential, until now, we have not been too invol

Comments for Question #9: Please describe the additional air sealing necessary to reach the required blower door test result of no greater than 5 ACH50.

1 Unknown
2 WRB and/or Air Barrier product upgrade, additional labor to properly install same. Additional labor and materials to better seal exterior walls to slab and walls to ceiling-level finishes. Additional labor and materials to better seal interior walls to ceiling-level finishes. Improved ceiling board-to-electrical connections detailing and installation characteristics. Additional labor and material to improve sealing around/behind cabinets, tubs and plumbing accessories. Relocation of HVAC equipment. Others, as applicable.
3 Because of the blower door test, it will reveal cracks and crevices missed during the standard sealing. Those areas will require additional investigation time and money to find the cracks and plug them. Sealing a building too tight and then having to use energy to cool and dehumidify outdoor air for ventilation is counter productive and an unnecessary use of energy. The minor cracks and crevices missed during construction will let in the necessary fresh air to the interior.
4 Re-seal all ducts, HVAC in closet re-seal closet, top plate on walls, add more insulation correctly, seal around all conditioned io unconditioned penetrations and better windows and sliding door requirements.
5 Unknown, Every house is different. The additional testing slows the project, adds cost, with no practical benefit to the builder or homeowner.

6 Additional air sealing measures usually include verifying that leaks into or from wall cavities have an effective air barrier, sealing return plenums and gaps between drywall and supply grills.
7 Sliding glass doors will prevent the structure from achieving 5 ACH50, and will need to be replaced by hinged swinging doors
8 you will need to install a drywall ceiling only. which means the insulation contractor will have to charge additional time because he cannot compete his job in one trip like before. you will lose a day waiting for the partial insulation inspection before you can drywall. the drywall contractor will have to charge more because he will have to install the ceiling only and the drywall finisher will have to flat tape all the drywall where It meets the top plates in order to get a good seal for the blower door test the area where it got flat taped will have to be retaped when the walls are finally installed
9 Double perimeter inner tyvek triple tape seals and double ship lap connections with fasteners
10 sealing electrical components, plumbing and ventilation wall/roof penetrations
11 Drywall penitrations, outlets, switches, register boxes, door jambs leak due to drywall not being sealed to the top plate. It would not be cost effective to seal. The benifits of a house that tight dont outway the cost to seal it.
12 Mastic and tape on most seams
13 Having to seal around boots on after sheetrock has been hung. Sealing air handler better then they are from manufacture. (They all leak, and none would pass straight out of the box)
14 If you make a house to tight you are going to have problems. And the added costs for these stupid tests are only going to make the testing companies money while taking money from the people that can barely afford to build a house. Total up all of the cost just to start building a house, ridiculous.
15 Sealing of the attic sheathing and roof penetrations from below
16 The attic would have to be sealed completely and fresh air mechanically introduced into the structure.
17 Sealing all the wholes created by each trade with foam, paying extra to the plumbers, electricians and insulated to do this on each of their part. Insulating the heat trap of the water heater, providing enough mastic and tape to keep from leakage, adding step up trusses to allow for enough insulation closest to the eaves, making sure that each attic knee wall has 6 sided construction means paying more for the framing to be done properly, the delay in time to do all of this.
18 Sealing attic and soffit with open or closed cell foam
19 would have to allow for time to reseal or recheck
20 Additional parts and labor for all items penetrating the barrier seperating the attic and living spaces. Component changes for bath fans, dryer vents, range vents and etc to include tight backdraft dampers.
21 Spray Foam Insulation
22 Plate sealing. Prescriptive framing. Drywall butt joint and penetration sealing.
23 IF EXISTING CONSTRUCTION: SEALING WINDOWS-DOORS-TOP PLATES-GASKETS BEHIND COVER PLATES FOR DEVICES-ATTIC ACCESS SEAL IF NEW CONSTRUCTION-LESS COST-LESS LABOR-TOP & BOTTOM PLATE SEALS-SEALING WINDOWS-BETTER ATTIC ACCESS SEAL

24 Ceiling penetrations, ductwork
25 Duct drop penetrations, all penetrations from unconditioned to condition space have to be re-sealed in most cases.
26 More attention to insulation details, callbacks if blower door test results in leakage greater than 5 ACH50.
27 seal around all outlet plates and switch plates, seal around all A/C vents, Seal all attic access covers, seal drywall to framing top plate, seal around light fixtures and can lights.
28 If the home is built to code from the very start there shouldn't have to be any additional air sealing necessary. However, with that being said, most homes are not built to the FBC.

29 All vents and duct work would have to be improved. All wall penetrations would have to be sealed better.
30 This is very much a mystery, but could involve all sorts of areas.
31 Light fixtures, additional caulking and labor from painting, stucco, siding and house wrap contractors
32 In non-foam attic insulated home, all penetrations through drywall (eg hvac supply/return vents, lights, fans, etc) will need to be caulked to ceilings which must be done after drywall installation. This is expensive based on how much extra electric people are requiring these days. Also, the blower door test will slow construction considerably since you will need to to seal everything up, then you will have to wait on the rater (people are busy are never available the day you need them), then the house will need to be cleared for the rater, and then you will need to wait on the report to get a final inspection.
33 We have been using open cell foam and having extra sealing measures for many years but realize that is over the minimum required by code. Foam sealing around the windows and doors, foam pads under the exterior doors, open cell foam in the attic. We have a thermal by pass exam performed to determine if any spots are missed. These are not by code but are additional costs up front.

34 Caulking HVAC registers to drywall. Using mastic to seal all of the HVAC duct joints.
35 Can lights would have to be sealed and any other wall/and or ceiling fixture that is not stereotypically caulked in-place
36 do not know as it is not required here
37 actually building it to code and following manufacturer's specs
38 Why would you have a code official take this survey?
39 It is unknown at the moment at what point a house will be tight enough to pass this test. If a house can be tight enough prior to sheetrock, then the cost of the test would be a burden as well as additional sealing. If you need sheetrock up to pass and you don't, then it is incredibly hard to find your leak and therefore would become costly into the thousands to purchase and rehand sheetrock

40 All electrical outlets and lights, hvac
41 Additional labor and time to seal various leaks i.e. vents outlets etc.
42 Plumbing & electric box/panel penetrations, repair weather door/window stripping gaps, seal attic access hatch. Caulk seal trim, baseboards. These would not need to be done after air sealing, if they were done properly as normal best practices by the trades. This is normal punch-out work in quality construction. Pay extra at the end of the job to meet code for one home only as a learning experience. This should not be repeated if and when a quality air barrier inspection is routine, and not just signed off without compliance. Does the builder who routinely fails READ the EPL cards? I would like the signers of the EPL cards take a quiz on what he has signed. These builders don't read it and don't care. It is not a cost issue it is proper installation issues, quality assurance that builders are resisting. These builders need to add "Caveat Emptor" to their new home sales contracts and not make false claims on their building permits.

43 Additional weatherstripoing, door seals and rebuild door jamb
44 Foaming and caulking
45 Depends on doors, windows, and insulation selected and installation techniques.
46 many different task were done
47 Ceiling/attic penetrations
48 Unknown but any new code always has additional costs
49 Sealing of all framing members, sealing of all jumper ducts and wall assembly whichin it lies, sealing of all outlets and wall penetrations.

50 More perimeter caulking/sealing
51 All entrances exterior and adjacent rooms,sliding glass doors,windows.
52 Mastic interior of flex duct before sliding on collar, mastic collar into box, fab and mastic vapor barrier to box
53 windows, doors electrical outlets and light fixtures interior.
54 mastic of all connections in duc ts and grille boxes and return s
55 Bath and kitchen venting will need to be sealed better.
56 Option does not give me the opportunity to put I do not know
57 Gaskets @all penetrations
58 Seal bottom plates, seal around AC supply & registers with chaulk after drywall, seal around all ceiling outlet boxes, seal all plumbing, electrical, low voltage drill holes in top plates.
59 inner/outer rings/collars each opening with sealant between each termination.
60 Seal Supply Air and Return Air Boot Boxes to drywall surface
61 seal around door
62 Sill, Plate, Door, Window, Eave, etc.
63 mecanical sealing with tapes and paints to complete sealing of ducting
64 seal around recess lights, attic access panels, A/C vent grills
65 AHU Closet must be sealed 100%. MO's and RO's must be sealed from the inside. Thresholds must be sealed.

66 100 percent positive sealing backdraft dampers for exhaust fans 200 to 300 per fan plus access doors for motors
67 recepticles, exhaust fans,
68 the window and door bucks to window frames would need sealing. any thru the wall pipes would need to be sealed. The attic access would need to be sealed. The a/c ducts thru the ceilings would need to be sealed.
69 Better windows, better doorsand better wall construction.
70 window door perimeters attic and exterior wall penetrations
71 sealing of lights, windows, doors,
72 MASTIC,TAPE,SHEETMETAL,TESTING PREP,UN DUE TESTING PREP,AND A NON UNIFORM BUILDING CODE THAT VARIES THROUGH OUT THE STATE,COUNTY TO COUNTY,AND CITY TO CITY.
73 3rd party duct sealing, proactive testing. Quality installation alone is not enough.
74 sealing around all light fixture, return, supply, and penetrations in the ceilings
75 Seal canned lights, seal hvac boots, better seal attic access, add a bead of calk along with the sill seal under the bottom plate; as well as, a bead of calk along the top plate.
76 Based on residential projects I've done in other states to meet LEED Gold and HERS score of 70 or less, which roughly equates to 5AC50, the amount of sealing is significant compared to typical residential construction. Electrical outlet boxes, wall/floor joints & intersections, interior wall intersections at outside walls, rim joists, roof penetrations and wall penetrations all must be thoroughly addressed. In some cases, we've had to revise industry standard details, such as roof penetrations, because sealing around the annular space alone isn't enough.

77 Exterior walls - become ICF Attic - No soffit vents, closed cell 2 part foam insulation underside of sheathing and over soffits, this requires conditioning attic space (increase in ducting and unit size) Ventilation - Assume humid area in Fl, Requires ERV and dehumidifier to cope with added air change.
78 Many homes are not meeting the code, and the additional cost is what they will have to spend to do the job correctly.
79 Going to leak free ducts and the material / labor of HVAC subcontractors to seal the ducts with mastic. Also the cost of the leak free duct test as well as the blower door test.
80 Detail sealing and caluking at all drywall penetrations
81 Some locations of AC units, i.e. attic, make it more difficult to seal. Code compliance allows some units to go in the garage. Also, and unfinished door may not be sealed properly. Some are not sealing around grilles. One instance was where the front door wasn't properly installed and it showed on the blower door test.
82 Sealing around all light fixtures and cans, sealing around all A/C vents and returns, sealing drywall to framing top plate, sealing all attic access panels

83 Greater care would be needed on the duct collar with mastic on both sides of the flange. Register boxes would have to have all seams sealed with mastic. Air handler would have to have cork tape at drain and refrigeration line penetrations and wiring penetrations. All panel seams taped. Mfg oil residue on duct collars would have to be cleaned off
84 for inner liner to secure 100%
85 Typically, foaming around outlets, lights and a/c grills. Anywhere there are drywall penetrations.
86 the inspectors in this area do not inspect insulation so the insulation is not properly installed. and for it to be properly installed the installers charge extra to do that.
87 depends on the swing of the door, and locking mechanism, A one point lock system, full light that swings out would let a lot more air past, than an in swing doors, you need to use windows they would have no flex To them. you will get different reading from and in swing or and out swing. and 1 point lock vs. 3 point lock, also different air flow from a full light vs. solid door. your not testing apples with apples.

88 Caulking / Sealing of exterior bottom plates and all top plates. Sealing of gaps in stud stacks and gaps between bottom plates and sheathing.

89 penatrations thru drywall recepticles
90 Duct, doors, vents, fans
91 significant duct sealing...drywall sealing...better dampers on exhaust fans, dryer vents & range hoods
92 Recessed lighting Where walls meet ceiling Window frames

Sorted Comments for Question #11: Are there any factors that would warrant a substantial increase or decrease in your cost estimate?

Decrease

Builder Experienced / Prepared

1 house ready to test upon arrival
2 Builder familiar with air sealing and testing
3 Builder is always ready on time with work done correctly.
4 Builder knows what he or she is doing set several homes up in the same area to test, however I do not give discounts!
5 Builder spends the money and does it right the first time.
6 Building preparation is completed by the general contractor prior to the testing agency arrival to site. Testing agency would only be responsible for conducting the test.
7 Cost could be reduced IF the home was ready and there were more than one home in a given location. Volume discounts.
8 Helpful people who facilatate to co-oridinate this work in a timely fashion and work schedule.
9 If the builder has done his own blower door test prior to the certified tester doing the real test and finds that everything has been tightly sealed.
10 If the home is built correctly and to best practices this action should cost little.
11 Past history of other homes by builder

Smaller or Simpler House

1 8' ceilings and less rooms
2 production built home
3 smaller house
4 Square box

Close Proximity / Volume

1 Close location
2 Decreased cost if multiple blower door tests could be done on the same trip
3 Doing several tests in the same area on the sam day.
4 High volume in one location
5 if the builder has multiple homes ready for testing in the same neighborhood
6 location: if within 10 miles or less of my office location
7 Many unit close to each other that can be tested the same day.
8 More than one house ready and available at time of testing and work done to proper standards
9 Multipe homes in same area, having builder assist in keeping site clear of trades during testing
10 multiple homes (3 or more) same site same day 10% discount
11 Multiple homes in same area available on same day
12 multiple houses to be tested in same area
13 multiple tests within a same subdivision
14 multiple units in same complex
15 Volume in the area, vacant home with no workers, simple paperwork process.
16 volume of wobs in same neighborhood
17 volume pricing same specs house

Economies of Scale

1 More competition if this is a required test and costs may go down a little.
2 Scale of economics-more to do equals less to charge.
3 On going building ,testing more homes
4 The more we test the more costs will go down over time.

Other

1 access
2 an assistant
3 continual success of a sampling protocol
4 cost of equipment & labor
5 high quality of trades (to seal) would possibly eliminate re-testing
6 If a better wall system was use (ICF or SIP) then the level of sealing and insulation would not be as great.

7 If the home has a foam attic the likelihood that it will not make 5 is slim. This would also insure for a faster in and out since you won't have to isolate the duct system. Or if the home has all ductless units.
8 job conditions
9 Multifamily / townhouses
10 Not having to re-test
11 Passed the first time.
12 Utility rebates if available, homes close together, signed contract from builder, A/C contractor relationship.
13 Simple design of doors, multiple tests for bulk discount, if several

No / None

1 My prices usually stay the same. I don't t tend to go lower because the time it takes to test a 1500sqft house and a 2000sqft varries little in time. The majority of my associated cost come from reporting to RESNET, licensing fees, computer program cost and the Insurance policy that RESNET demands I have in order to test the house.
2 na
3 no
4 No
5 no
6 No
7 No
8 No savings
9 none
10 none
11 none
12 none
13 None

Unclear or Unresponsive

1 construction components
2 Discontinue the test all together
3 Do away altogether with this blower door requirement and let the market place demand the service, or have the utility industry fund is own energy saving programs with dollar for dollar rebates.
4 EASE OFF ON THE LESS THAN 5 AIR / EXCHANGES FOR MECHANICAL VENTILATION REQUIREMENT
5 probably no need to do a smoke test for leakage is sealed properly this time. Only need to do the blower door test.

Sorted Comments for Question #11: Are there any factors that would warrant a substantial increase or decrease in your cost estimate?

Increase

Additional Time / Delays

1. Added time for adjument modifiers and simple reporting requirements
2. additional contractor/scheduling etc
3. Additional labor to man the project will the blower test is being completed by the 3rd party. Correcting items that are damaged during the construction process.
4. Builder does not communicate schedule accurately, causing repeat visits to job site.
5. change orders
6. Cost of test, costs of down time and remobilization.
7. Envelope not ready
8. House not ready for testing. Required work not completed. Only single house available at time of testing.
9. if the house isn't test "ready"
10. improper scheduling /
11. Resistent people who fail to co-oridinate this work in a timely fashion and work schedule.
12. Scheduling requirement, after hours work, turn around time on paperwork

Larger or More Complex House

1. Accessibility, Design of doors, Ceiling height (20'+)
2. Complex structure
3. Complexity of home. Access to mechanical systems that need to be shut down and sealed for the test.
4. custom built home
5. Fireplaces
6. High ceilings / multiple return air ducts /
7. How many windows. doors penetrations ?
8. If the home is larger then you have to charge more, if you make any pre-dry wall visits, this will increase the cost. Which should be done to insure that the blower door will test correctly
9. Large Kitchen Hoods and/or multiple fireplaces
10. Larger homes requiring multiple blowers
11. multi story, more openings such as bath fans etc.
12. multiple air handlers
13. Multiple HVAC systems, remote location,
14. multiple stories or larger home with multiple systems
15. Number of doors or windows above average.
16. second story / inadequate opening for test equipment / Combustion appliance present / Duct testing
17. size of home
18. size of house, travel
19. Square footage , access, door openings, High end finishes have to be much more careful
20. Stilt home, fireplace(s)
21. The only price increase I would have to charge for would be if the house was so large that it would require a second blower door to depressurize the house or if the homeowner/builder wanted thermal images of the home taken durning testing.
22. vaulted ceilings
23. vaulted ceilings, high stairwells
24. Who wrote these questions? / Of course there would be an increase, whether it's substantial depends on the cost of the house.

Repeated Failure / Additional Sealing Required

1. Additional time to test the project and additional reporting and repairs to effected areas if needed.
2. Blower door test, someone on-site to correct any sealing deficiencies.
3. continual failure
4. have to be present for blower door testing to correct any problems on the spot to pass or pay for an additional test and return
5. if builder and trades were not trained in proper air sealing techniques then repeated failures would result in higher fees
6. If the house fails resealing would add to cost.
7. If the house fails, we would have to locate the leak source.
8. If the house is extremely leaky and the report involved a lot of description. If the house were fueled by gas, it would add additional cost due to making sure proper gas procedures were followed and calculating the CAZ for the home. If the house was not ready for inspection at the time it was scheduled.
9. If things need to be fixed and builder is not spending extra money.
10. If numerous leaks detected and then time waiting for them to get plugged and then retesting to see if it worked; if testing finds that builder did not seal the ducts or lights and tester has to wait around for that to get done before performing the test

11 Inability of the builder to make the house compliant.
12 multiple retesting, if necessary
13 poor test results
14 Poorly sealed that would require several re-tests.
15 Remaining on the job while house is repaired to get it to pass.
16 Retest. Code understanding. Inspection results acceptable to county. Stopping construction. Redoing work.
17 Retesting due to failure of seals, additional costs to the contractor to bring a new crew to the job site
18 Retesting, problems getting into the home, lack of communication.
19 Retrsting
20 Significant number of duct leaks or high infiltration.
21 Time, material, testing, correcting, re-testing, loss of time in schedule
22 Trying to find leakage in concealed spaces could take up to 8 hours and require smoke testing at an additional cost. Accessing areas for repairs could force removal and replacement of finish materials adding days of delay and costs of up to $1,000.
23 Having to provide assistance in guaranteeing home sealed and ready for test, no control of other trade activitie during testing

Distance / Travel Time

1 Area built within Florida (North or South). Quality of materials used on the house.
2 Distance away,
3 excessive travel, immediate service
4 location: distance from my office location, if over 50 miles.
5 travel time
6 Travel time
7 Very isolated location

Other or Multiple

1 Assuming the house is a spec, you have to assume the cost of the test itself, loss of labor on the house during testing, and the interest lost (at minimum) for the one day of testing. If the house does not pass, you would have to factor additional interest and expenses.
2 availability of independent firms to complete the test, quality of workmanship by various trades (to seal)
3 Better construction practices
4 builder's who are idiots/don't listen/don't care
5 Construction components
6 Contractor did a poor job of constructing and detailing the house, or value engineered components out of the design.
7 County required inspection would substantially increase cost
8 Designing somewhere inconspicuous for the outside air intake. / / Possible whole house dehumidification system.
9 Depends on the level of test required and what certifications you are trying to attain
10 drywall , insulation ,Extra time for the testing and extra time for the partial inspection (drywall screw, insulation)
11 if correct energy measure were not employed by the builder
12 job conditions
13 lack of involvement, hard to get into homes, no A/C contractor involvement, homes far apart, homes over 2,000' living, detached or 2-story homes and having to go back to retest.
14 Location of air handler
15 Missing attic hatch, multiple seprate caz zones as blower door testing inspector would want to verfiy caz zones are functioning properly. Dealing with building code inspector when tthey have no clue and either want to learn and slow us down or act like they know and red tag everything when no problem exist.
16 MORE GOVERNMENT REGULATION
17 Pay for rater, extra sealing
18 Poor HVAC installation
19 Power and start up prior to CO. / Delay move in. / / Don't see economic return, particularly fro affordable housing.
20 Sub standard builders incapable of reading writing the English language
21 Summer rains will impact the ability to conduct the test.
22 Tenant separation walls
23 With anything new, you always have "hidden costs" that do not appear until after you start doing it.

No / None

1 no
2 no
3 No
4 No
5 no
6 no

7 no
8 No
9 none
10 none

Unclear or Unresponsive

1 Although our previous fee for completing a blower door and duct test were $150 each, this fee doesn't recover our expenses and is being reviewed and likely will be increased if we continue to offer the service.
2 800
3 2500
4 3500
5 5,000
6 325 / We have construction loan costs of $150/day per house, so $75 was added to the cost of the test, because we will delay construction completion by 1/2 day.
7 Additional time to conduct the testing. The cost of the testing. Additional measures if the test fails. Fresh air intake ventilation.
8 Additional cost to turn over the product
9 As with all engineering, a two dollar test can tell you enough sometimes and too much spent only gets a hell of a lot graphs and pictures.
10 builder will caulk every penetration. but in 3 to 5 years caulk would fail due to age, expansion/contraction, But the caulk would be behind the finishes (drywall, trim) and could be serviced or maintained. Result, builder pasted test, homeowner paid for test, System return to present day level of "air tightness" with age. HVAC contractor got a new boat for doing all the test.
11 Code requirements that facilitate leaks and require the builder to correct in field during construction.
12 Expansion of scope of required work , schedule , time and money
13 extra testing, prep time involved, accessibility to property
14 Having to do the testing
15 I believe all this sealing is making sick homes. Need to go back 20 years in code to make everyone happy. /
16 Improved indoor air quality and reduced energy cost
17 It's too much to ask for
18 Labor
19 More time to install, return to make corrections and more materials to complete job
20 no examples time and material base
21 Sealing of penetrations to drywall, testing cost, time cost
22 Soffit edge sealing
23 The testing and sealing
24 these codes are getting out of control.....
25 Third Party Needed
26 This $79 dollars is the price to get my house blower door tested in my part of Florida by an independent contractor.
27 time
28 Time
29 time associated
30 Time needed to get the official test result.
31 Trying to understand the intent of this question - is it "What factors would waarant the increase in cost?" / If that is the question, then lots of factors will cause the costs to increase for this work. / Worst part is that the costs must be passed on to the buyer, along with the builder's cost of money, real estate commissions, overhead and profit, etc, / So, no matter what the cost is you need to add a mark-up of between 30 to 40% to arrive at the economic impact of this change.
32 We required door and window wood bucks to be installed in full sealant bed. There must have been an additional cost for this but it was never itemized.
33 window selection and Sliding Glass door instead of Prehung doors /

Sorted "other" responses for Question # 13: WHOLE HOUSE MECHANICAL VENTILATION SYSTEM What type of 2014 Florida Code compliant whole-house mechanical ventilation system would you specify for the EXAMPLE HOUSE (select one answer):

Dehumidifier Based

1 Whole house Dehumidifier
2 Any outside air introduced should normally include dehumidification. For commercial buildings we like to include CO2 sensors to determine when outside air is really necessary. 5 air changes per hour seems like a lot considering ASHRAE
3 supply only with O.A into a whole house dehumidifier, then into the AC system with combination temp, humidity,
4 HRV and ERV are not a good solution for Central Florida's tropical climate. A mechanical whole-house dehumidified such as the Honeywell DR90 is the only proper way to bring in outside air. Cost to operate but removes risk of high humidity
5 Fresh air supplied through a whole house dehumidifier to the a/c system with a ventilation controller
6 dehumidifier
7 Whole House Ventilating Dehumidifier
8 use dehumidifier to pre dehumidify air before it enters the return plenum. Similar to ERV, but better in the high humid south florida environment.
9 Outside air delivered to a dehumidifier. Then the dehumidified air would be delivered to the air handler.
10 Depends on zone and current humidity. High humidity outside air must be conditioned before introduction to house, via either dehumidifier or AC unit equipped with reheat or dehumidistat control. Low humidity outside air can be directly introduced via same distribution system when conditions permit.
11 dehumidifier with outside air supply

Other

1 The ventilation systems I use depend on what the builder wants to spend. For climate zone 2 ventilation only will cause humidity problems inside the home. So I will give the options of Supply only - Duct line pulling outside air into the rerun side of the AH Supply only - Using a dehumidifier to pull outside air (which works better than an ERV in the houses I have used them) The next options are based off of the last two but have temperature and humidity cut offs so the system will not pull outside air if it is too hot or humid and to add some form of timed intermittent exhaust. When I use a timer to bring exhaust on in a house I never exhaust more air than I am brining in. Also note that all fresh air intakes are
2 MECHANICAL VENTILATION WITH OPERATION OF THE HVAC SYSTEM. CONDITIONED ONLY WITH ERV WHEN A HIGH DEMAND OF VENTILATION IS REQUIRED
3 Any system that connects with the outside
4 Location dependent base primarily on average dewpoint temperature- and type of construction
5 Cannot be determined with the information provided alone
6 Never exhaust as incoming moist air into building cavity equals mold. ERV is balanced but consumers want to know what's wrong if you use the cheaper Panasonic unit or other brands use lots of duct vents. In-take from the return air side using the Honeywell 8150 is ok but it follows the ashrae 62.2-2010 and not 2013. I would like to see a humidistat on exterior so at 55% it would turn system off or best of all use a Carrier Green speed so the a/c system becomes a
7 Supply and balanced, Positive return each living space.
8 Fresh air duct with damper and humidty control at stat.
9 you need both supply and exaust. to keep static pressures balanced
10 I DON"T KNOW
11 Dedicated Outside Air System (DOAS) or a system that is designed to handle outside air by reducing the latent load to an extent that does not raise the interior space relative humidity when supplying the outside air.
12 Bath exhaust timed with HVAC on off times.
13 Continuous duty rated bath exhaust with on off switch
14 The way I am reading this code, coupled with best practices, there is only one very expensive answer - an HRV or ERV
15 Pull outside air at eave through return to go through unit for conditioning. Prevent negative pressure on house.

None / Don't recommend

1 NONE

2 No additional ventillation is needed. If you seal the home tighter as a result of trying to achieve 5 ACH50, then mechanical ventillation may be required and more humity and mold issues will arise when homeowners fail to maintain

3 I would not specify. If so mandated it would be the simplest system with the lowest cost.

4 Do not recommend

5 none why would you want to pull hot humid air into a home?

6 I wouldn't even attempt to describe what you're emplying the cost and time would exceede the need.

7 N/A minimum FBC compliant house has infiltration through CBS, soffit venting, etc.

Unclear or Unresponsive

1 You people are going straight for the same problem we have in commercial buildings " called sick building sydrome" If you make a house to tight and don't let it breathe you are CAUSING a problem. And should be sued accordingly for

2 don't understand your question

3 When a building is built so tight that little air is turned over you run the chance of making a sick building. The air has to change, wither your bringing in fresh and pushing out the old or using an expensive air purification system like Lennox

4 MAKE UP AIR TO THE EXHAUSTING APPLIANCE OR SYSTEM

5 I wouldn't put more than this, you will end up running the a/c and costing the home owner more in utility costs.

6 200

7 I am not familiar with the mechanical ventilation systems listed. My experience is limited to blower door testing for this

8 Duct work inside the condition space. Air handler in the condition area. No unsealed fiberglass duct work. Good thermostat regulates system when no one home and zoned according to use.

9 NONE AS YET

Question #15: Comments on estimate [of cost to builder for whole-house mechanical ventilation system specified for the example house in Q13]:

1 $1200 for ERV, $600 Installation Materials, $400 Labor, and $600 Overhead & Profit
2 AC tonnage will increase to dehumidify and cool the hot, humid outdoor to be brought in; mechanical fan with damper; ductwork to the exterior with screened opening
3 motorized ventilation damper interlocked with ahu fan motor
4 This is completely dependent upon the type of product installed
5 Panasonic or Aprilaire systems are easily installed for approx $450 to $500
6 Price will be highier or lower depending on the size of the home.
7 18 seer trane system with fresh air intake and humidity control
8 Assuming home already has a programmable thermostat that interfaces with mechanical damper.
9 Can be costly to maintain all spec clearing and service requirements
10 Includes electrical
11 if you require the systems to be tested, retested and comply with some value that is to costly to achieve than it defeats the purpose to try to regulate the process.
12 Extra labor time to make sure system is totally sealed, including boots to ceiling. Motorized damper to bring fresh air into return at air handler. Filter box at air handler and insulated duct and gravity dampers to exhaust the old air.
13 Again, this mandate must have immediate payback and be self funded, preferably by the industry which it intends to benefit (utility providers). Few buyers care about whole house ventilation system, especially in a 2,000SF home nor do they request this self imposed system. They merely seek a responsibly built affordable home. Regulation are juxaposed to affordability and whole house ventilation systems are a rich mans game.
14 Cost can vary depending on the contractor and amount of duct work needed for ventilation. Cost can also be effected by the amount of ventilation needed and upgrades desired. Cost may also increase depending on the thermostat that the
15 To do it correctly will require a a filter at the source of outside air, and a backdraft damper to minimized the quantities.A sensative pressure sensor near the main return would activate the fresh air fan.
16 If you only do wall controls and timers with a better than normal exhaust system the cost shouldn't be too bad, but if you have to put in a system that runs with the a/c, the time and cost will increase and also the humidity in the home.
17 it would be dictated by the size of the house
18 dehumidifier controlled properly introduces possative dry air to the home in our climet conditions.
19 could be much higher if load on house increases or need for better latent load controlling system like variable speed or 2
20 Cost will come down with more installations.
21 electrically controlled damper
22 Best case in our climate
23 PENDING UPON AMOUNT OF VENTILATION. A STANDARD HOME REQUIRING THE MINIMUM OF 45-CFM SHOULD BE ABLE TO BE PERFORMED WITH AUTOMATIC DAMPER TIED INTO THE HVAC SYSTEM AT THE STARTING AMOUNT
24 Dependent of ease of installation
25 need only upgrade bath fan to qualifying type
26 A/C contractor same amount of work-up grade of materials. More framing and sheet rock. Some builder creativity on
27 This is for typical Honeywell 5101 controller and Damper installed on a isolated run to outside, 6" flex or 4" dryer duct
28 none
29 unknown
30 This is a very costly item at around $3,000 per home, but the impact to sales price is even worse, adding about $4,000 to the sales price of a new home.
31 Builder would doing the very minimum to keep cost reduced. What good would this testing actually do for the
32 Clients will not want this and it will be painful. Clients will not use how intended so it's not going to work. Also, when we mention a controlled air intake to homeowners the let us know they don't want it or tell us they will disconnect
33 exhaust only may be an option if a dedicated make up air vent with filter and damper is installed. This would resuklt in a substabntial resuction in cost.

34 This includes a panasonic ERV, associated ductwork, additional electric, and labor, plus a return visit to set the proper time setting for the ERV
35 many hard costs still unknown as well as time costs
36 This is the cost for hard duct installed from an exterior vent cap to a time controlled damper that ties into the return of the air handler. Plus, the HVAC system may need to increase in size to account for the additional load to condition the hot, humid air that is now being pulled into the home through the fresh air intake.
37 not including permits; ERV install and wire $1200, HVAC fresh air in w/ controler $550
38 As a rater I am not privy to the cost or time of installation.
39 I believe the price varies on square footage of the house and tonnage of action unit
40 Use an existing hall bath and install energy star exhaust fan with ashrae a 62.2 ashrae compliant controller
41 Equipment manufacturers are making units now that comply with the needs for this due to code use in South Carolina etc. This should not be a surprise to anyone.
42 With home owner option educated to overide control.
43 Cost should actually be part of the A/C system package.
44 depends on the brand
45 Estimate based on experience of having such equipment & installation back in 2005 - 2007 on similar square footage with foam insulation (iceneene) to roof decking in attic areas.
46 labor mateials
47 System system will require filtration, motorized damper with humidistat control, inline manual damper and separate mechanical dehumidifier if built in coastal city
48 Basic bid
49 depends on type of Air Duct Material used.
50 just a guess
51 to many unknown factors to give honest estimate
52 If a dehumidifier is used the cost would increase to $3500.00
53 could go up or down depending on size & location
54 Based on material onlu
55 ERV should always be used in Florida due to high humidity.
56 depends on number of units and cfm required
57 per sf
58 home owner savings goes on and on.
59 Need a filtered fresh air supply duct and a motorized damper controlled by the operation of the HVAC.
60 SWAG Need contractor's pricing, not Rater"s
61 at 4 people, 15 cfm per person = 60 cfm. it costs about $2/cfm/month to operate, which equates to about $1440/year to
62 just a guess
63 The outside air system is a combination of a controller and a damper. This would require a roof jack, 6” round connecting duct and tying in to the return air duct on one of the systems. This add would generally be priced around $1,200.00) The whole-house dehumidifier is one of the standard models we use. This unit requires two duct connections to one of the HVAC systems and would have an installed price around $2,400.00.
64 do not know specific cost of unit or installation. lack of knowledge of this equipment
65 Either upgrade to a better AC unit equipped to do the job, or a dehumidifier integrated into the AD duct/distribution system. To consider introducing unconditioned outside air into a house in zones 1 and 2 is a disaster waiting to happen.
66 Been doing this for years now.
67 The typical system we've been using is AirCycler G2k
68 Infiltration not addressed?
69 Mechanical contr. installation and additional capacity of system
70 This cost is per air conditioning system
71 I really don't know -- I'm guessing, since I haven't had the experience of this installation yet. I have a project nearly ready to permit, and will learn the costs associated with the code requirements.
72 All Bath fans and Kitchen hood

73 Not sure; do know Habitat Houses doing something similar to meet Energy Star.
74 ducting to exterior and interface controls can easily add 1000 to price
75 100

Sorted comments for Question #17: Are there any factors that would likely warrant a substantial increase or decrease in your cost estimate for the EXAMPLE HOUSE?

Decrease

Home Size

1 Size of home
2 size of house
3 Size

Shorter Ducts

1 Shortened duct length.
2 Short OA duct.

Simplified Systems

1 Use exhaust only as indicated above.
2 Much cheaper is to use a simple outside air duct with motorized damper connected to the heat pump fan (damper opens when fan is running), but it is highly inefficient, especially when humid outside.
3 Less expensive equipment can be used
4 Go to an exhaust only strategy

Accessibility Related

1 job conditions
2 easy attic access
3 acess
4 Easy access for outside air duct opening and duct run.

Economies of Scale

1 The more houses are tested, the lower the price should become.
2 Increased competition for sales of dedicated outdoor air systems.
3 Practice - once it is implemented a few times, it's fairly easy.
4 quantity and experience gained in the process. And the lower prices for the equipment once they became standard requirements.

Other

1 Use of equipment designed for this environment to comply with the code.

No or None

1 No
2 none
3 no
4 no
5 none
6 No
7 no
8 None
9 No decrease the price is the best deal and you would have to wait for contractor to have a dead time in his schedule if you need it when he is busy just double the price.
10 No, with a tight house you must add pre-conditioned air into the house to make up for kitchen and bath fans.

Unclear or Unresponsive

1 Had more information on cost. I'm not a contractor.
2 If the ASHRAE standards were really looked at for Florida hot humid climate to determine that 5 may be to high of a number to force ventilation.
3 Same
4 NOT HAVING THE NEED TO DO THIS AT ALL, OR CHANGING THE REQUIREMENT FOR VENTILATION JUST BECAUSE THE HOUSE IS BELOW 5 AIR EXCHANGES PER HOUR
5 Delete this code
6 Opposite of above
7 not sure
8 na

Sorted comments for Question #17: Are there any factors that would likely warrant a substantial increase or decrease in your cost estimate for the EXAMPLE HOUSE?

Increase

Home Size

1 Larger and/or multi-level houses.
2 Size of home
3 size of house
4 Size
5 Space

Complexity / Additional Equipment and/or Materials

1 More materials, labor and design time on each job
2 another step involved in the building process, another inspection, another document required, another step by the contreactor, = more time= more $
3 House with multiple systems. Long duct run. Requested upgrade.
4 Distance and route to be taken of duct
5 Length of OA duct; issues with the pressure sensor, and maintenance of all components.
6 If the design specified supplying a separate AC system just for conditioning the outdoor air intake
7 the size of dehumidifier required for the size of the home, they range from 70 pints to 205 pints per day.
8 Going to Balanced system with HRV/ERV
9 see above 2 speed or variable speed system
10 Air handler in conditioned space -upgrade material-time in planning lay out of duck work.
11 obviously more ducting, controls and dampers
12 Install dehumidifier for outdoor air.
13 It was assume going thru gable wall, going thru roof add $600. Two-stories with 1st floor could range from $300 to $2000 more depending on floor joist design and any required soffit. for ERV. The new A/C has to be resized and increase to cover the extra incoming air. average adds $1,500 more.

Time Related

1 Inspection lag. Correct work. Leaks. County compliance.
2 time
3 TIME
4 Increased time, cost of the ventilation system, and maintenance.
5 Distance to travel
6 Increase in scope, time and money
7 Time and material. An Air Conditioning unit is not a ventilator!!! Must have independent source. ERV, BVS. NOT to tie to the RETURN OF AIR HANDLER !!!
8 travel

Accessiblity Related

1 Required clearances and intake modifiers
2 No easy access for outside air duct opening and duct run.
3 Existing conditions
4 Placement - Location - Feasibility
5 serviceable location with access needs to be provided unless ceiling mounted model is used. control wiring and control

6 job conditions
7 flat roof
8 Room allowance for equipment installation
9 Retro fit
10 Long duct lengths, access to entry and exit louvers/grills

Regulation Costs

1 yeah government regulations
2 MORE GOVERNMENT REGULATION
3 Everything that code asks for is an increase in un-necessary costs.
4 yes if ad any more changes to the existing code
5 Cost of new technology or of mandated technology.

Other

1 Having to retest
2 Price increases
3 With anything new, you always have "hidden costs" that do not appear until after you start doing it.
4 If additional ventillation is required, lawsuits related to mold and humidity problems when these systems fail could be in
5 Poor construction coordination, value engineering, weak subcontractors.
6 change orders insulation changes
7 lack of understanding on how to do it right, a negative attitude in wanting to do it and lack of concern for the health and comfort of the occupant, and a lack of concern or ignorance about the energy savings that would be achieved by the occupants being comfortable at a higher temperature when the air is drier.
8 Education - not knowing what to do.

No or None

1 None
2 no
3 No
4 none
5 none
6 no
7 no
8 none
9 No

Unclear or Unresponstive

1 not sure
2 na
3 how could it not add cost
4 1000
5 1000
6 at 4 people, 15 cfm per person = 60 cfm. it costs about $2/cfm/month to operate, which equates to about $1440/year to
7 This system works best in our southern climate because we are not pulling in hot moist air the majority of the year. We build ICF block houses that are very tight. We don't need unconditioned air being added to our houses. The cost of whole house ventilation would not only add to the cost but to the homeowner ever month because of the HVAC running more

8 Cost of sealing the house and ducts to meet code along with the testing and re-testing fees
9 If the ach50 is much less than 4, then the home will end up with make-up air and ventilation pulled through the air handler, this gets very costly. Also timers and brands of exhaust systems in the bathroom to meet the proper cfm can be very costly. Including the cost of extra dampering to keep air from winds or storms from blowing back in.
10 Cost of compliance will not provide a return on investment, especially for affordable housing.
11 Our homes are extremely tight, and would probably need the outside air to generate the 5 air changes requirment
12 Improved indoor air quality. The other ventilation methods would lead to substantial risk and likely moisture damage to the home and it s contents
13 These pieces of equipment are very expensive and production of them has matched demand - which has been very low.
14 Cost of labor, materials, time, electric etc.
15 Family activity, glass , insulation
16 use Sheet Metal Duct/ and Foil back Duct Insulation.

Sorted comments for Question #19: If you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE, please estimate the

Increased Equipment Size

1 added capacity to counter effects of ventilation not factored in manual j
2 Additional BTU capacity
3 additional capacity for ventilation requirement.
4 ADDITIONAL UNIT SIZE TO FINISH DEHUMIDIFICATION PROCESS IN HUMID INVIRONMENT.
5 Air handler in most cases will have to be increased .5 half a ton to help reduce the added RH%.
6 capacity
7 Cost may be zero but system needs to be sized appropriately to account for outside air being introduced
8 Depending on how you are bring in the outside air you will have to increase the size of the Heating/Cooling system.
9 Enlarging the system tonnage due to increased heat load on building
10 Equipment would need to be sized to include O/A temperature and humidity load..
11 Equipment would need to be slightly oversized to compensate for the warm outside fresh air. And I would recommend to my customer to go with, at minimum a two stage system.
12 Extra HVAC capacity to overcome the added load
13 HVAC- Size of unit increase could cause install concerns or space required.
14 If the outside air is not dehumidified completely before introduction, the equipment tonnage would increase to handle the additional latent load.
15 I'm not sure the of the expense; however, it's likely to increase because the system will need to be sized to handle the additional ventilation air, ventilation ducting/damper will need to be installed and the power bill will also likely increase because it'll need to run longer to remove the moisture out of the unconditioned air that's being brought in; as well as,
16 increase by .5 ton to offset hot and humid air being drawn in by the system. If ERV is installed, up front cost might be more, but this increase size may not be needed due to the ERV's capacity to cool and dehumidify.
17 increase in a/c tonage
18 increase in btu of system
19 Increase in equipment size or type
20 increase in sizing approximately 1/2 ton to overcome the temperature of the entering fresh air
21 Increase in tonnage to offset the amount of outdoor air. Increase in SEER to offset cost of running larger unit.
22 Increase in unit size. Extra outside air filter
23 Increase tonnage; multiple compressor stages
24 Increased tonnage to condition hot, humid outdoor air intake; motorized damper; more sophisticated controls
25 it could increase the size of the ac system
26 Larger ac
27 Larger AC Unit
28 Larger air conditioning equipment to accomodate bigger heat load and higher humidity levels.
29 Larger or higher efficiency unit
30 Larger system or system equipped with dehumidification accessori8es
31 Larger system, means larger duct work, means more expensive
32 Larger ton system and ductwork
33 multiple manual-j's and increase a/c capacity $1,500
34 Not sure what the increase in load would be and the cost based on introduction of mechanical ventilation
35 Possible increase in cooling, heating load
36 redo load calculations
37 The cost may be an increase in HVAC size. Normally if a blower test is being preformed this can be avoided because I can be certain of how tight the house will be using the blower door infiltration method on the heat load software I use. / Having a blower test done makes the mechanical engineering more accurate. If I know a builder has to commit to a certain infiltration rate I don't have to guess what I think it might be.
38 This is a cost allowance to increase the size of the system by 1/2 ton.

39 upsize ac system wuth variable speed a/h /
40 Upsizing of system to accommodate fresh air
41 We typically see a 1/2 ton increase in equipment size to overcome to heat gain from the ventilation product.
42 You will have to increse the size of the HVAC to overcome greter heat and humidity removal. We currently build 1144 sq. ft houses using ICF blocks. Our air calulations useing a Manual J is .9 of a Ton of AC. Our Ac units run on Humitity rather then temperture because of our tight houses. Every home is certifed to DOE Zone Energy ReadyHome.
43 You would either have to increase the capacity (especially latent) of the AC equipment or install a dehumidifier.

Variable or Two-speed Equipment and Related

1 Adding humidity will require two stage equipment to keep the indoor humidity around 50%. Or a dehumidifier which will cost more for a whole house model
2 better equipment 2 speed or variable speed
3 Bringing additional humid air into the home requires more work and higher performance by the HVAC equipment to
4 Bringing hot humid air into the home will require different units to effectively handle it.
5 single stage to two stage system
6 To do this in our humid climate would necessitate a two-stage outdoor unit, or a dehumidiifer added to the central
7 Would need to install variable speed Condensing Unit.

Dehumidification / Air Treatment (including variable speed AH)

1 air filtration (salt removal) extra fan with power/wiring/controls
2 Air handler to be variable speed matched with thermidistat control
3 better humidity control in some regions
4 erv installed in most holmes insulated with r-30 or less
5 having to overcome additional outdoor hot, humid air (most months) when cooling
6 I would specify that the contractor install a humidifier (in the sealed attic, attached to AHU) in order to dry the air within the house and lower the needed use of the HVAC system to dehumidify.
7 If untreated air is brought in to the a/c system there needs to be some way to increase the latent heat removal
8 South Florida humidity issues and concerns may require dehumidification equipment
9 The HVAC contractor would need to add a dehumidification to the system. Any time warm moist air is added to a tight home, additional dehumidification needs to be added to remove the moisture
10 Variable speed airhandler and ventilation/dehumidification controller
11 Whole house dehumidification systems will become the norm once houses are required to be too air tight.
12 Whole house dehumidifier

Higher SEER

1 It may require higher SEER unit and additional ductwork with change in material
2 SEER Upgrade
3 up grade of seer rating , unknown to me exactly how much this testing will cost
4 Upgrade in A/C equipment as well as upgrade in attic insulation, wall insulation, windows and doors to meet these criterias, cost of testing and reports and extra charges from building authorities to review the information.

Ventilation Equipment and Related

1 add one duct for fresh air / additional cost for the special air handler
2 additional controllers and damper systems
3 Additional equipment needed to supply proper ventilation.

4 Additional fan and electrical connection costs. Everything else should be considered in the system design. If constructed well, additional capacity should not be warranted.
5 Changes to duct system to interact with erv
6 Connection of communication duct to outdoor air, controller, damper, duct, and labor to install and seal
7 cost of extra duct-work and control damper for outside air to be brought in
8 damper control to allow fresh air in while system is operating.
9 Duct system connection points to the grill
10 larger plenum, more tape, more mastic, additional piping, cut into the roof and piping to go higher than the roof plan, items to keep the roof from leaking with the new penetration.
11 material & labor
12 Need ducting and dampering from the outside to the return at the unit. Has to got through attic. Depending on the house, it may be a tight space.
13 roof penetration(s), additional electrical hookup. additional ducting
14 Run additional ductwok
15 Testing. Equipment. Lost time. Compliance.
16 Timer switch for bath fans

Multiple and Other

1 added cost from sub contractor
2 Addition equipment always means additional expense.
3 Additional energy efficiency, additional equipment, additional ducting, and additional labor.
4 Don't know the costs but, I believe the variety of choices would decrease.
5 ducting changes / insulation changes / resizing unit
6 Equipment ,labor
7 Higher than min. code requirement,
8 minimal as it would be part of design
9 Need to rework the supply and return air ductwork if the plenums are not sized large enough for connections from the
10 New specs , equipment , seals , insulationbaffles , house wrap requirements
11 re-calculations
12 size of equipment may go down with proper use of HRV/ERV system due to latent load decrease vs. traditional return air
13 system engineering, manual j calcs
14 The cost of the equipment can be reduced because variable speed equipment is not required to control humidity.   The standalone ventilator can be sized to perform that function in off peak times.

Unclear or Unresponsive

1 already discussed
2 as noted in the last question
3 cost actually goes down on the AC if you use the open cell foam as you use a smaller size system.
4 I DON"T KNOW
5 see previous
6 unknown

Sorted "other" comments for Question #20 responses: If blower door testing is required in the FUTURE, who would you expect to offer blower door testing services (select all that apply)?

Certified Rater / BPI

1 RESNET approved techs
2 Anyone certified to perform the test.
3 In Florida code it says that only certified raters are allowed to do building envelope and duct testing. So we are the ones that I expect to offer the services.
4 Clas 1 Florida Energy Raters, best choice
5 HERS field inspectors
6 Only qualified pro's that have passed core testing! and are licensed and insured
7 BPI, and RESNET certified people should be the only people doing the test. Independent from the builder. Blower door testing on a gas home can be dangerous if someone is not trained properly. this is not a one day course to understand the properties of house science.
8 Only BPI certified contractors, they have more knowledge and understand if the house is to tight what effects not only moisture has but the ability for a gas appliance to draft and or kill someone. Not Resnet as they have seen less unique and odd homes.
9 Those who have taken and passed a course on blower door testing, and who are somehow regulated--ie: DEPR, CILB or BPI, RESNET.
10 Certified building airtightness professional
11 BLOWER DOOR TECHNICIAN UNDER SUPERVISION OF HOME ENERGY RATER CERTIFICATION.
12 RFI
13 BPI
14 independent licsensed BPI, or equivent certifications

Third Party

1 or any trained 3rd party contractor
2 a third party tester not affiliated with the builder or sub contractors would be required by most jurisdictions
3 County approved independent testers.
4 LEED/FGBC/NGBS third-party green home verifiers
5 IT ABSOLUTELY SHOULD BE PERFORMED BY INDEPENDENT THIRD PARTY INDIVIDUALS, WITH RANDOM AUDITING AS IS CURRENTLY PERFORMED BY FSEC!!
6 third party
7 Someone who is third party. Builders don't need to police themselves, unless FSEC is doing checks and balances on the builder provider. A lot of builders tell me they will depend on their HVAC guys for this.

Test and Balance Companies

1 Test and balance testers in the HVAC industry
2 test and balance companies
3 Existing T&B subcontractors

Other

1 Code enforcement partnership with utilities.
2 Testing labotatories
3 Those who are familiar with ventilation and how a system works.
4 Mechanical engineers
5 Foam insulation contractors
6 Engineering Consulting firms that provide testing and inspection services
7 new profession "Door tester"
8 Mechanical Engineers
9 All will want to for various reasons. Depends on training requirements of testers.
10 Although there are lots of various options for people who can perform such testing services, I think it'd be best to consult with the County Building Officials for direction and recommendations.
11 Most all of the above, whether they are qualified or not. The consumer will look for the lowest cost just to get by the code. They are not interested in the value of the test.
12 Specialists who concentrate solely on the blower door test and remediation efforts to help contractors achieve the required results.

13 Home owners
14 Homeowners
15 crooks, thieves and liars

Unclear or Unresponsive

1 Not practical
2 NONE
3 And done at no-cost
4 Waste of time and money if builder is doing his job and inspectors are too.
5 The equipment and testing is really a waste of money for the homeowners. The estimated savings is never accurate because every family lives differently and the testing is based Soley on a set standard.

"Other" comments for Question #25 response: What resources would you need to double the number of blower door tests annually (select all that apply)?

1 We can't as we offer it only with our own efficiency program
2 we pay the rater
3 Funds
4 more avalable jobs
5 already have a second BPI cert Tech on staff
6 Additional training for new personal
7 additional personal and equipment

Sorted "Other" comments for Question #27: What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to comply with Florida Code requirements if/when the legislative delay ends (select all that apply)?

Dehumidifier Based

1 Whole House Ventilating Dehumidifier
2 Whole house dehumidification added to supply intake
3 supply with mechanical dehumidification
4 Outside air delivered to a dehumidifier. Then the dehumidified air would be delivered to the air handler.
5 dehumidifiers with filtered outside air
6 Supply only Ventilating dehumidifier Supply with exhaust (positive pressure to slow down infiltration throughly building leaks) Ventilation with temperature and humidity cut offs
7 And the mechanical whole-house dehumidifier.
8 Whole house dehumidifier
9 dehumidifer

Simplest / Lowest Cost

1 We would specify thew simplest system with lowest cost. Its interesting a requirement such as this is passed, or a trial ballon floated, without a cost study and then seeks input from those upon which it is to be imposed after the fact.
2 use what is needed for code
3 This would be the least cost and consumers don't care about all the fancy gagests they want a home they can afford. We are really making affordable housing a thing of the past and we are going to loose a whole market of consumers that can no longer afford a home.

Balanced Supply and Exhaust

1 again you need balanced approach, both supply and exaust
2 Exhaust and Supply
3 Balanced with exhaust fans and damper to allow for fresh air. .so basically a balanced system.

Dedicated Outdoor Air Systeem

1 Dedicated outdoor air systems and possibily the use of an ERV.
2 Dedicated outside air with manual and powered damper ducted to a stand alone dehumidifier with controls

Bath Exhaust Fans

1 It has been my understanding that point source exhaust fans such as bath and range WOULD count toward the code mandated total
2 continuous duty rated bath exhaust with on off switch - per ASHRAE 62.2

Other

1 Based on test will decided what is needed
2 ventilation air of proper amount, 15 cfm per occupant, provided during runtime only is proven very effective to pressurized / eliminate infiltration
3 Coupled with some means to control the added latent load.
4 I have been installing 15 / 16 SEER Variable speed air handlers for the last several years, and installed a mechanical damper/controller. full foam house with 1/2" dow blue board on most homes (est. 15 homes)
5 specifics would be determined by my mechanical engineer
6 depends on the location dewpoint temperature, type of construction, habitability and typicall ari infiltration rates expected
7 Add fresh air intake to the return plenum of the HVAC system.

Unclear or Unresponsive

1 see above discriptions
2 I don't agree with mechanical ventilation for all instances in Florida. In many cases, the outside air is far more dangerous than stale inside air. Especially in instances with high pollen and pollution. Cleaning the air prior to introduction is not cost effective. No such thing as Exhaust only ventilation. If you blow air out, it has to come in from somewhere and that is not always a controlled or desired source.
3 It's all an expense that home builders and home owners don't need in this economy.

Sorted comments for Question # 28: Why would you specify this/these types? [of whole-house mechanical ventilation systems to comply with Florida Code requirements if/when the legislative delay ends]? (Includes responses to Question #27: What type(s) of whole-house mechanical ventilation systems do you plan to typically specify to comply with Florida Code requirements if/when the legislative delay ends (select all that apply)?)

	Humidity Control Related Comments	
	Q. 27 Ventilation System Type(s) Specified:	**Q.28 Comment:**
1	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Applicable for the temperature and humidity levels in Central Florida
2	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Because in a HOT and HUMID environment, such as anywhere in Florida, to bring warm, moist air in from the outdoors without first conditioning the air to remove moisture, is something only an idiot would do on purpose. / Over the past 30 years we have seen lots of very bad unintended consequences come about as a result of great sounding ideas, this feels like one of those... / What if we have some smoke in the air and bring in all that "fresh" air - full of smoke into the house without first filtering the smoke out? We could injure the occupants of the home by allowing this to happen. / Who wants to be responsible for that?
3	Other- outside air delivered to a dehumidifier. Then the dehumidified air would be delivered to the air handler.	Because outside air is very humid and the humidity needs to be dried before it is delivered to the space, otherwise there is a great potential for mold.
4	Other- Dedicated outside air with manual and powered damper ducted to a stand alone dehumidifier with controls	best overall performance of outside air and pretreatment of outside air and humidity control. The A/C units are left to exclusive cooling loads only and not dehumidification.
5	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Control dehumidification and cleanness of intake air
6	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); other- Whole house dehumidifier	Control humidity
7	Other- continuous duty rated bath exhaust with on off switch - per ASHRAE 62.2	dramatically reduces the likelihood of moisture related issues within the home
8	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Ensures that outside air is introduced only when the AC condenser is operating thus not to load the house with moisture
9	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Florida has high humidity. You can't just add a 6 in run to the return of an air handler and possibly think that is fine. Direct humidity to a unit that was sized for the inter loss/gains is not correct. You also need to make the building positive in pressure, not negative.
10	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Florida's climate
11	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Gives some dehumidifying capability and puts house under positive pressure.
12	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Help condition the air due to high humidity levels
13	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	High heat and humidity year round in South Florida, ACH50 in this area without ERV would cause AC to run more than without ACH50 and normal infiltration
14	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); other- supply with mechanical dehumidification	high humidity concerns and mold and mildew
15	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	humidification of outside air is important
16	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Humidity control
17	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Intake air must be filtered and conditioned before being brought into the space or one is asking for mold trouble by just dumping hot, moist air into the interior. It is self defeating to button up a building so tight to then cut a hole into it to bring in outdoor air.

18	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); other- Whole house dehumidification added to supply intake	Intake air will be between 60 to 70 relative humidity
19	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	IT IS THE ONLY WAY TO REDUCE OVERLY HIGH HUMIDITY OR OVERLY EXPENSIVE EQUIPMENT
20	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Latent heat removal
21	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Our climate demands that if outside air is used, it must be dehumidified. Using an air handler with control and an erv allows for some humidity control. Additionally, it provides better source control and distribution of outside air to the conditioned spaces.
22	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	The non-energy recovery systems would introduce unconditioned outside air into the home, or introduce it sporadically, which would lead to greater indoor air quality problems than no ventilation system at all
23	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); Other- And the mechanical whole-house dehumidifier.	The outside air must be dehumidified prior to introduction to the house or the risk of mold and etc from high humidity is unacceptable.
24	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	to avoid extra humidity being introduced into the house causing mold issues
25	Other- Dedicated outdoor air systems and possibily the use of an ERV.	To ensure the proper air quality within the house and not raise the relative humidity through other methods allowed.
26	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	to help control the latent load added to the house
27	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	To prevent moisture damage
28	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	We specify ventilation systems that utilize compressors to remove moisture before the preconditioned air is introduced into the air handling units. These are the only types of systems we have found to provide consistent indoor conditions.
29	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	-With the exhaust system you can get a good estimate of the infiltration and possibly undersize the equipment to help control the humidity by having the equipment run longer (bc it is undersized). / -With the supply only system with runtime control you ar

Cost and/or Simplicity Related Comments

	Q. 27 Ventilation System Type(s) Specified:	Q.28 Comment:
1	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Best for the money
2	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Cheaper than the right way (which is a dehumidifer)
3	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	Cheapest
4	Exhaust only (excluding occupant controlled kitchen and bath fans)	cheapest and simplest
5	Exhaust only (excluding occupant controlled kitchen and bath fans)	Cheapest, easiest for homeowner to understand and can control personal preferences and not a "standard"
6	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	compatible with cost effective Equipment.
7	Exhaust only (excluding occupant controlled kitchen and bath fans)	cost
8	Exhaust only (excluding occupant controlled kitchen and bath fans)	cost
9	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	cost

10	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	cost and simplicity of meeting requirements
11	Exhaust only (excluding occupant controlled kitchen and bath fans)	Cost by builder and competition ability plus cost
12	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	cost factors
13	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Cost is less, it dehumidifies most of the time when a/c is running, it's easier for a a/c guy to understand and any home pressure would be relieved through the spot exhaust ventilation piping and damper even when not running.
14	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	costs
15	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Ease of installation and cost effective
16	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Ease of installation, minimal cost
17	Exhaust only (excluding occupant controlled kitchen and bath fans); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	exhaust because of lower cost. ERV much better choice for effectiveness and practicality
18	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); other- Coupled with some means to control the added latent load.	Keep first cost down, and minimize maintenance costs.
19	Exhaust only (excluding occupant controlled kitchen and bath fans); other- This would be the least cost and consumers don't care about all the fancy gagests they want a home they can afford. We are really making affordable housing a thing of the past and we are going to loose a whole market of consumers that can no longer afford a home.	Least cost
20	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	Less cost impact on both builder and consumer.
21	Exhaust only (excluding occupant controlled kitchen and bath fans)	Most cost effective
22	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Most cost effective and most reliable design/system.
23	Exhaust only (excluding occupant controlled kitchen and bath fans); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	One for install cost, one for operating cost.
24	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Seem to be the less expensive way to comply
25	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	Seem to be the most affordable at this time.
26	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Simple and very little cost.
27	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Simple to install, Conditions outside air as it enters the home.
28	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Simple to install, minimal additional equipment, minimal homeowner involvement.
29	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	simplest
30	Exhaust only (excluding occupant controlled kitchen and bath fans); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Simplicity, cost effectiveness.

31	Exhaust only (excluding occupant controlled kitchen and bath fans)	The Exhaust Bath Fans using the Smart Switch is the least expensive way to meet the code so that is the way the Builders will go Florida does not need to bring outside air with 90% Humidity in to any home
32	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	Trying to keep the homeowner issues to a minimum in regards to cost and operation.
33	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	It seems it would be more cost efficient if it was included in the HVAC service.
34	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	lease intrusive.

Energy Efficiency Related Comments

	Q. 27 Ventilation System Type(s) Specified:	Q.28 Comment:
1	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	better for energy consumption and they dont create a pressure difference in the home. less dirt infultration
2	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	efficiency, better humidity control
3	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Energy efficient and practical.
4	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Most effective
5	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	most efficient
6	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	most efficient
7	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	most efficient
8	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Most efficient, and will precondition fresh air entering house at the air handler.
9	Exhaust only (excluding occupant controlled kitchen and bath fans)	Other systems would waste to much energy
10	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Preconditioning outside air is critical to energy savings and maintaining net positive building pressure.
11	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	seems to be most efficient
12	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	these two can work in tandem to provide sufficent ventilation at a reduced cost

Experience / Works the Best Related Comments

	Q. 27 Ventilation System Type(s) Specified:	Q.28 Comment:
1	Other- dehumidifiers with filtered outside air	because they work great
2	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); other- I have been installing 15 / 16 SEER Variable speed air handlers for the last several years, and installed a mechanical damper/controller. full foam house with 1/2" dow blue board on most homes (est. 15 homes)	Been installing them for several years and have had no problems.
3	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	have used
4	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	It has been working for my clients for 10 years.
5	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	It has worked the best for over six years that we have been build high energy efficient homes.
6	Other- depends on the location dewpoint temperature, type of construction, habitability and typicall ari infiltration rates expected	Experience
7	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	it works

8	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	They work best with the building science we use on all of our homes already.
9	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	They work. Tested these systems in GA & TX
10	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); other- see above discriptions	we have been installing this type of system for well over 10 years with good results, and have solved problems in existing homes.

Code Minimum Related Comments

	Q. 27 Ventilation System Type(s) Specified:	**Q.28 Comment:**
1	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Code compliance
2	Other- use what is needed for code	code requirments
3	Exhaust only (excluding occupant controlled kitchen and bath fans)	only thing required by code
4	Exhaust only (excluding occupant controlled kitchen and bath fans)	Only to comply
5	HRV (heat recovery ventilator) or ERV (energy recovery ventilator); other- specifics would be determined by my mechanical engineer	to meet code requirements and provide a tight building envelope
6	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	To meet the code requirements
7	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	every situation is different, but we have to do what the code tells us. We need to pre dehumidify the air before it enter the coil, so ERV/dehumidifiers are the best option down in south florida

Pressure Related (Balanced or Positive) Related Comments

	Q. 27 Ventilation System Type(s) Specified:	**Q.28 Comment:**
1	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	ERV first as a balanced system will perform better is cost is not an issue. The others if cost is an issue.
2	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan)	It brings the house to a positive pressure in comparison to negative pressure pulling air through the wall assembly. The additional fan over the air handler will use less energy.
3	Other- again you need balanced approach, both supply and exaust	it would be balanced, not creating a negative pressure(exaust with no supply) or positive pressure (supply with no exaust)
4	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	the houses need a balanced air exchange
5	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	To keep a slight positive pressure in the house. We don't want a negative pressure in the house which would suck humid air into the walls which would cause mold and be an energy penalty. / We want to dehumidify the incoming air with the air handler or an ERV.
6	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	We would install supply only to create a positive pressure on the inside of the home, because we are in a humid climate. Exhaust only could create a negative pressure, which would pull moisture into the home (his is an undesired condition). And, energy recovery ventilators are too expensive.

Other and Multiple Comments		
	Q. 27 Ventilation System Type(s) Specified:	**Q.28 Comment:**
1	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Because of the varied home stock available
2	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Because we would need to leave it up to the homeowner. The homeowner would drive which way they wanted to go
3	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Better air quality for all Florida residents.
4	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	better comfort control potential
5	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	a good and better scenario options for the builder/homeowner. I think builders will use this law to justify extra building costs and be able to blame it on the state
6	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Best way to bring in outside sir
7	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	Builder preference
8	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); other- Balanced with exhaust fans and damper to allow for fresh air. .so basically a balanced system.	Builders requirements and budget. All are different.
9	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	CONTROL SYSTEMS ARE INCORPORATED INTO THE AIR HANDLER CONTROLS FOR AIR MOVEMENT. ESTABLISHES ENVIRONMENTAL CONTROL OVER THE SPACE AS WELL AS THE NUMBER OF AIR CHANGES.
10	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Demand ventilation strategy
11	Exhaust only (excluding occupant controlled kitchen and bath fans); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	depends on the house size
12	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Easiest for installation and uses HVAC to condition air.
13	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Good solution to manage indoor air quality.
14	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	I feel it the best answer for florida
15	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	It can be controlled by the air handler

16	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); other- Supply only / Ventilating dehumidifier / Supply with exhaust (positive pressure to slow down infiltration throughly building leaks) / Ventilation with temperature and humidity cut offs	It is important to remove off gasses from inside of the home as well as remove carbon monoxide from gas cooking appliances or invented gas fireplaces that vent the gases into the living space. / Having a supply strong ventilation system will keep unwanted outside air outside of the home. The outside air that is brought on is filtered and dehumidifier thought the AH filter and coil which provides increased comfort and safety to the homeowner
17	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	It's the right thing to do. Did you see the options to the question? / I don't see how this survey can assist you.
18	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); other- dehumidifier	more control
19	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	runtime with Hvac best for dehumidification, filtration and positively pressurizing the home. The exhaust fan method will be more cost effective for builders entering this arena for the first time. Teach them to walk then run...
20	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	SEEMS LIKE THE BEST OPTIONS TO MEET THE CODE, BENEFIT THE CONSUMER AND MAKE / IT THE EASIEST FOR ALL PARTIES INVOLVED
21	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator); other- Based on test will decided what is needed	Testing
22	HRV (heat recovery ventilator) or ERV (energy recovery ventilator); other- Add fresh air intake to the return plenum of the HVAC system.	The ERV has an addition of air along with the removal of air thus balancing (in theory) the air. The fresh air into the return plenum allows the warm moist air to be conditioned (dehumidified) and moisture to be removed.
23	HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	the ERV partially / conditions" the incoming fresh air by lowering the temperature before it enters the home environment, thus lessening the extra time to cool the air by the AC system during the air return cycle. Also, has a filtering system to filter out impurities from outside air.
24	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator	The outside air has to be cooled or heated before entering the home.
25	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	We currently recommend these systems in houses insulated with foam.
26	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	We've been specifying the Air Cycler G2k (in other states), because it measures the outdoor air, and has a computer that interfaces with the bath exhaust fan and the air handler. Greatly reduces the amount of outside air brought in versus un-monitored systems.
27	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	Proper sizing. one contractor.

Unclear or Unresponsive Comments

	Q. 27 Ventilation System Type(s) Specified:	Q.28 Comment:
1	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	For 2000sf have not found the requirment to add outside air, yet
2	Exhaust only (excluding occupant controlled kitchen and bath fans); Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller)	I don't want to do any of them. The customer is burdened enough.

3	Exhaust only (excluding occupant controlled kitchen and bath fans)	It is house, houses have multiple doors and windows with multiple people in them that open and close these daily. given the square foot opening of a door and the given square foot of a house any system design for pressure control would be managing exhaust, if you try to manage fresh air it would be a complete was of energy and long term life of the units
4	Exhaust only (excluding occupant controlled kitchen and bath fans)	No comment
5	Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); other- ventilation air of proper amount, 15 cfm per occupant, provided during runtime only is proven very effective to pressurized / eliminate infiltration	yes
6	Supply only: ventilation fan delivers outside air into the house (not via the main air handler fan); Supply only: runtime with control (ventilation air distributed via AC air handler with ventilation controller); HRV (heat recovery ventilator) or ERV (energy recovery ventilator)	yes

Sorted Comments for Question #29: Are there any types of whole-house mechanical ventilation system you would not specify to comply with the Florida Code requirement?

If Doesn't Pre-treat Outdoor Air

1 Any system that does not pre-condition the outside air or continuous intake without being treated prior to distributing into the building envelop.
2 Absolutely. No systems that would just dump outdoor air into the interior without it first being dried out and cooled.
3 yes, i would not specify a fan only or exhaust only system without the ventilation air being conditioned prior to mixing with the indoors, the v/a must be introduced as close to the indoor coil as possible / runtime with call on cooling or heating - air handler fan only operates on a call for heat or cool (never continuously)
4 Type that introduced outside air into the home without going through the hvac system
5 Systems which involve putting untreated air directly into the living space or into the air handler. Both of these options have side effects that builders and homeowners will not tolerate, except for the price for being code compliant.
6 Any system that did not temper and dehumidify the incoming air, preferably through energy recovery
7 Systems that do not incorporate humidity control.
8 System that bring outside air directly into the house or AC systems that allow outside air in when the cooling compressor is not running.
9 BLOWER BRINGING IN OUTSIDE AIR INTO THE HOME, 24/7 AND NOT INTRODUCED THRU THE HVAC SYSTEM
10 unconditioned outside air introduction to house
11 Straight venting from the outside to the air conditioning closet, or ductwork, etc. or any other venting that does not condition and filter the outside air first.
12 any system that does not provide some sort of humidification. and exhaust only systems- we are trying to maintain a equal pressurized building while eliminating any uncontrolled air infiltration
13 hot/non pre conditioned air entering the coils. Also no way should we just have fresh air entering the space without being treated.
14 Not pre conditioning outdoor air
15 I would not specify a system or method by which outdoor air is supplied to the house untreated (not dehumidified to 50% or less of space conditions). Introduction of outdoor air that is untreated will lead to uncontrolled relative humidity inside the house thereby providing thermal discomfort and providing a mechanism for potential mold development. So, those types of systems are direct ventilation through exhaust fans without equipment to treat incoming outdoor air from relative humidity.
16 There will be many problems if designers/contractors don't pretreat the humid air. Exhaust only provides negative pressures, seen in many mold infested homes. Supply only does not pretreat the air before it is delivered to the space, much like opening a door! Not a good choice for Florida. But if designs are made this way, we'll have a lot of work fixing the problems they generate!
17 Would not specify any system that allows large amounts of humid outdoor air in without conditioning the air and monitoring the flow to reduce wasted energy.
18 Ventilation only using untreated outdoor air.

Exhaust Only

1 Exhaust only (inconsistency, spottiness, unverifiable true production). Supply only not integrated with dehumidifier (would introduce too much moisture into the house
2 Exhaust. Due to wet hot air in florida and it being a big problem making the house depressurize and the damage and comfort issues that come from that. Plus transplants from up north and out west where its drier wanting wood flooring that warps from humidity issues.
3 Ventilation only The reason is because ventilation only forces air though the buildings leaked to try to replace the air being exhausted. This results in increased humidity inside the home and can lead to moister problems. If there are cumbustion appliances in the home having a negative building pressure will not allow the gasses to exit in the desired area and will lessen the amount of cumbustion air available.
4 Exhaust only ventilation because we don't want a negative pressure in the house which would suck humid air into the walls which would cause mold and be an energy penalty.
5 Exhaust only, there is no control over where the outside air is coming from. Though it may be the cheapest, it may lead to future moisture problems in the room that contains the exhaust fan.
6 exhaust only
7 As stated above, exhaust only systems could potentially create an undesired negative pressure on the inside of our homes. Pulling moisture into homes could create conditions that are susceptive to mold growth.
8 Exhaust only
9 No negative pressure unless I had really good insurance as 100% of all systems that suck air unbalanced out of the home will be covered in mold the first year.
10 exhaust only supply only
11 Exhaust - kitchen fresh-air. Bringing in high humidity
12 Exhaust only - This does not control where air is introduced into the house and could lead to building issues
13 Exhaust only, you are air through contruction material not intended to be filter material
14 Exhaust only, Florida has and will be utilizing Fuel Gas, especially Natural Gas. This presents problems the average skill level having been used in this state. Contractor as well as Employee.
15 Exhaust only.
16 Exhaust only

17 Exhaust Only

ERVs or HRVs

1 ERV, not cost effective or efficient with Florida's high humidity level.
2 HRV's-Excessive maintenence and lack of humidity control. Whole house not connected to HVAC-no humidity control.
3 ERV systems, they have no affect on latent heat, only sensible. will create moisture problems if used.
4 HRV does not allow for dehumidification.
5 ERV. Won't control humidity in our climate.
6 ERV
7 HRV are not the best choice for a hot, humid climate.
8 HRV (would substitute ERV)
9 ERV
10 HRV and ERV - would not provide adequate dehumidification of the incoming air and would likely cause condensation in the occupied space Supply Only - most of the time in Florida you would be pumping in large amounts of hot and humid air into your cool space leading to condensation and potential mold growth
11 HRV - not good for hot and humid....

Continuous

1 continuous ventilation
2 CONSTANT VENTILATION OR MANUAL VENTILATION. WILL NOT PROVIDE THE NECESSARY AIR CHANGES IF NOT MANAGED.
3 I would not want to use the continuous run fresh air system because of our location in the southern part of the state. I think Hot moist air entering a tightly sealer house would be the worst thing I could do to our homeowners.

Other

1 Definitely would not use or recommend heat pump in sw florida
2 supply air only just introduced into the house
3 Honeywell Y8150 due to excessive power consumption. Limited flexibility
4 outside air ducted to return without accessible filter media
5 Positive pressure -- if the buildng is not properly sealed and has frmae constrution air exfiltrating has beeen know to condense in the walls/corners and only gets dsicovered later when mold or rot is present. Positive pressure exfiltraion ahs less predicable paths. Particularly during hihgs wind events.
6 I would discourage any system that uses the airhandler blower to distribute air due to energy costs involved in using such a large blower to move a very small amount of air.
7 Any if they operate at ASHRAE 62-2 levels
8 Commercial type sysyems
9 supply into ac equipment
10 ALL EXCEPT ERV'S AND THEY CAN CAUSE PROBLEMS ALSO
11 Forced air independent of the mechanical system
12 There are too many to describe here.
13 I Believe their should be no outside air brought into a home in Florida
14 Aprilaire 8191 and 8192
15 Exhaust / supply only - requires natural air leaks to balance. Natural air leaks in shell is infiltration.
16 The Honeywell fresh air ventilation system. Runs on a cycle, turns on the blower to draw in unconditioned outside air.
17 supply continuous during hvac runtime
18 bring fresh air into the air handler, here in Florida, the air is full of salt and damages air handler coils.
19 exhaust only and supply only with no limit control
20 Air intake only systems. They allow moist air into the home and trapped in a tight home.

Unclear

1 you mean like the current code allows. ERV's are used on all my homes.
2 Uncontrolled openings with opening that allow untreated air into structure.

Sorted comments for Question #32: Based on past experience, what would you expect the ACH50 to be in a CODE-MINIMUM new Florida home (three stories or less)?

ACH50 Range Related

1 I think below 5 is a good starting point for builders. Most of the new homes I tested were builder wanting to know how tight their house was and how then can get to under 5ach50. The majority of the houses that didn't meet 5ach50 were because contractors made penetrations through the buildIng thermal envelope and did not seal the penitearions, air barrier was not continuous, and parts of the house were missing insulation or were not air sealed. On the other end some of the houses I have tested were under 2ach50. Houses like this really need outside and the only you can possibly know is to test the house.
2 there needs to be a range, not just 5.0
3 This is a current average range as I've seen them
4 80% buliders already fall in the 3 to 5 ach50 range
5 Between 6.1 and 9 My old files not currently available.
6 This average should be around 5 and not allowed to be greater than 6. It only takes a little care and knowledge to accomplish this, not much money.
7 I believe that most (non Energy Star) new homes would score between 4 and 6. Large luxury homes with triple SGD's would score higher.

Unclear or Unresponsive

1 Sometimes more beau see of duct leaks and penetration leaks.
2 Only if the home is actually built to Code. Most failures are caused by errors not caught by Building Official.
3 Control infiltration with a slight positive pressure in the home and the ACH50 is not a factor.
4 Each home I have done as research for builders who look like they build well, but I didn't inspect as they built have all been 7-11%.
5 to tight is not good if indoor air is not cleaned properly.
6 three stories over simplfies most dsigns whihc have cantilevered floors and other difficult air infitrtaion areas to seal.
7 These were done at no charge. They were done for "fun" to see how the homes performed.
8 Form a rating system like AFUE Energyguide seen on gas appliance. Let the consumer decide if they want a tight home for additional cost and then bring fresh air into the home to offset the humidity.
9 ACH=

Sorted "other" comments for Question #36: Please use the table below to indicate the type(s) of whole-house mechanical ventilation systems you have installed in new Florida homes over the PAST TWO YEARS and estimate the average cost for each type (Answers must be a single number e.g. 0, 25, 405).

Dehumidifier Based

1 Outside brought in through dehumidifier
2 Dehumidifer
3 Ventilating dehumidifier (upgrade option usually by request of homeowner)
4 Mechanical Whole-House dehumidifier.
5 Supply only: through a dehumidifier with runtime control(Ventilation air distributed through the a/c system only when it is on
6 supply side only should have a built in dehu
7 Supply outdoor air via dehumidifier then into air handler.
8 Outside air delivered to dehumidifier to pre-treat. Dehumidified delivered to air handlers. Per system $4000 to install/$1440/year to operate. Our projects are extremely large estate homes, with multiple systems.
9 Condition the fresh air through a dehumidifier before introducing it into the home

Other

1 hvac
2 Hasn't been required. Did include it.
3 no information available to me on the cost
4 Do not recommend to our customers.
5 I meet ASHRAE 62.2 via a continuous duty rated bath fan with a labeled on off switch.
6 none
7 None
8 I don't install systems. I only provide consulting and teating.
9 None
10 Return side via control damper

Sorted "other" comments for Question #40: Why were the whole-house mechanical ventilation systems installed (select all that apply)?

Good Practice / Best for Project

1 Design required to meet comfort levels
2 best choice for job
3 Recommended by us
4 Good engineering practice
5 We believe they are a worth while investment for the health of the population and educate homeowners. All the VOC's release in a home frorm products we buy, mainly from overseas, go in to our bodies. Have you ever wondered why cancer has escalated in our country?
6 Per our recommendations to the homeowner. We do most of our installs on the waterfront in South Florida.
7 All mechanical systems that I design also have a four fresh air duct connected to the return of the air handler to provide fresh air and positive pressure.
8 It was best for the design and tightness of the home
9 ASHRAE 62.2-2013

Unvented Attics

1 We promote when spray foam systems are used
2 Foam unvented attics and projected house tightness.
3 We install these as a standard any time we use foam.
4 Nonvented attic
5 iconene attic
6 air exchange in homes with sealed attics

Other

1 interview with the homeowner so they understand the benifts.
2 Heating and Air Condition
3 Both were spec homes.
4 1. To provide additional dehumidification-with or without outside air - which may be necessary during an event with lots of people in attendance 2. To offset kitchen hood exhaust as most hoods are over 800 cfm.
5 HERS rating
6 Building official required it
7 calcs required them
8 Hood venting requirement when CFM of hood vent over 400. Building officials required it.
9 LEED and FGBC certifications
10 LEED certification
11 in pursuit of highest LEED level possible

None or Unresponsive

1 None required. Waste of money. Waste of time. Governmental interference.
2 none installed
3 we did not install any
4 none
5 none done

Sorted "other" comments for Question #42: Why was YOUR MOST RECENT blower door test conducted (select all that apply)?

Moisture or Other Issues

1 i use blower door test for homes that have high moisture content, checking the natural infiltration rate / and or / duct leakage (duct outside envelope) as a diagnostic tool, my MJ8 has data input for ach and blower door results
2 Mostly older homes because of high energy usage!
3 This builder was building his personal home and wanted to "make sure everything was done correctly" he had just recently changed insulation contractors because of the lack of quality the previous company was showing. He also wanted to make sure that his fireplace wasn't going to vent the gases back into his house like at his previous residence and request that the mechanical contractor added fresh air.
4 House humidity problems and duct sweating in attic.
5 Mechanical Engineer recommended the test to determine source of moisture entering the space.

Training / Demonstration

1 Building built for testing and training
2 we constructed one miniature training home just for this purpose
3 Just as a demo to see how the home performed

Other

1 to determine if building envelope had leaks
2 As a high quality HVAC contractor we insist all components be within conditioned space. Our builders meet that requirement with sprayfoam. We test the sprayfoam with blower door and require foam sub to correct significant leaks
3 Architect Specified
4 More energy wasre happens in Florida due crappy designed duct systems. Well over 33% waste in HVAC electric in the typical home, some homes even worst. Builders screw over consumers who have no idea of a properly deisgned and installed HVAC system by not demanding proper air flow by Manual J room by room design.
5 replacement
6 remodel on a 1973 home rehab project
7 Westernization grant
8 WAP inspection
9 LEED certification-
10 Efficiency program requirement.
11 Cost included all energy star testing as well as documentation and consultation costs

Sorted "other" comments for Question #44: What type of system was YOUR MOST RECENT whole-house mechanical ventilation system?

Dehumidifier Based

1 A dehumidifier with a flex line and damper to the outside was installed as well as a bath fan timer to have an 80cfm bath ran fun for 15 minutes out of every hour. The advantage of the dehumidifier is that it can dehumidify the home home without bringing the outdoor compressor on and it can work seperatly to bring in outside air and dehumidify that air without bringing the unit on.
2 Whole house dehumidifier
3 Install outdoor air via dehumidifier to air handler
4 Outside air delivered to a dehumidifier to pretreat air before it is delivered to the air handler(s)
5 Dehumidifier with inside and/or outside air distribution

Bath Exhaust Fan

1 just bathroom exhaust and natural ventilation
2 Continuous duty rated bath fan with label on the switch.

None or Unresponsive

1 none. it is stupid
2 as noted in earlier answers.
3 NONE INSTALLED
4 none done
5 n/a

Sorted "other" comments for Question #45: Why was YOUR MOST RECENT whole-house mechanical ventilation system included in this home (select all that apply)?

1	1
2	none
3	none, ever
4	By my recommendation
5	NONE
6	none done
7	Inspector
8	To meet building tightness limits. Ventilation failed and homewoner requested that it be removed. Resulted in Contractor purchasing a new HVAC system.
9	ASHRAE results
10	No vented attic
11	builder choice
12	as engineer of record
13	LEED Certification

Sorted "other" comments for Question #46: Why was this specific whole-house mechanical ventilation system selected (select all that apply)?

Recommended

1 Engineer's recommendation
2 Recommendation by Mechanical Engineer
3 as engineer of record it is a tried and true method of delivering air to the space, dehumidifying the space and maintaining occupant comfort.
4 I recommended it to the as the most economical and safe way to meet ASHRAE 62.2

Other

1 Meet min. Requirement of building official
2 The builder/homeowner didn't want the "basic package" and liked the additional features that the dehumidifier provided for his home.
3 it works
4 AHRAE 2013 required
5 Inspector
6 Based on home design it offered the fastest and simple to homeowner to understand
7 My choice, as I was the builder, homeowner, and system specifier

None

1 NONE
2 none done

Q 48. If there was additional HVAC cost to the builder resulting from whole-house mechanical ventilation, please estimate the cost and describe the expense.

Larger System	
$1,500	Larger HVAC system, supplemental dehumidification.
$450	Cost of system
$500	Tonnage increase
$5,000	replace HVAC
$300	Increased ac size
$1,000	Increase A/C system size
Dehumidification	
$2,500	dehumidifier
$4,000	Cost of dehumidifier and installation.
Delays / Additional Time	
$2,500	Caused delays in the construction, complications, and additional management time and cost.
$3,500	Time and materials
Other	
$500	Cosmetics
$500	Insulation
$500	Engineering design
$1,700	blower test and variable speed
$150	higher quality system
$350	additional vent into the soffit and and passive vent
$200	ON/OFF override switch so the owner can turn it off to save money and have less moist air coming into the home, but hey the met the ASHRAE requirment.
$1,800	Variable speed air handlers, thermidistat controls, intake duct and filtration along with control dampers
$1,800	Ducting & equipment.
$1,500	Automatic Fresh Air Dampers and Explaining them to the customers.
$3,000	Added duct, penetrations & equpiment cost
$250	Retesting and correcting performance settings and measurements
$5,000	HVAC controls to operate dehumidification system in different modes, ie., fireplace on, kitchen hood on, elevated space humidity levels, turn off the system while unoccupied, etc.
	extra sealing of envelope EnergyStar appliances
Unclear	
$450	COST OF UNIT / DUCT WORK
$5,000	Equipment and labor
No Description Provided	
$500	
$2,500	
$1,800	
$1,000	
$880	
$3,500	
$25,000	
$400	
$1,500	
$1,000	
$175	

Sorted Comments for Question #49: Any additional information or comments on YOUR MOST RECENT whole-house mechanical ventilation system?

Negative / Generally against Whole-house Mechanical Ventilation

1 Again , You "Engineers" you have zero time in real world situations and competency have no idea what your doing. Do you remember sick building syndrome ?? Was it that long ago ? If you make a house so tight it will require automatic door closers on all doors just to keep them tight against the door seals. A positively pressured home will push air out of the chimney , window seals, door seals cracks around lighting fixtures, fans, exhaust etc. All your doing is wasting MORE ENERGY.

2 This was and is a complete waste of client money

3 I would not recomend them to any client.

4 I have never installed one. they are stupid and counter intuitive to energy conservation.

5 Totally ridicules additional requirement

6 NONE. Comment: affordable housing 1000ft2 - 2000ft2 will not recover the additional investment

7 have not installed any whole house systems

8 no

9 I will never do this again. I would rather walk away from a job than deal with the nightmare brought on by whole house ventilation in Florida

10 No

11 Energy Star should be geographical. Nobody wants to automatically draw humid air into their Florida Home. We told customers to turn them to the off position

12 We do not need Whole House Mechanical Ventilation in Florida

13 We work primarily in the Atlantic coastal environment where extremely corrosive salt-laden air is present. Introducing air into the building reduces the life the equipment. If not extremely necessary, I would be a fan of not ventilating a house. Under normal occupancy and use, people tend to open and close doors frequently, and I wonder what the reason for outside air really is in residential. I agree that we should control uncontrolled infiltration by methods described in the code for building the envelop, however, the need for outside air ventilation in a residence should be evaluated in real life situations where normal people live in a house and come and go on a daily basis, multiple times. I can't imagine the build up of pollutants could happen that would warrant the need for dilution. (I do believe in dilution for commercial occupancies because pollutants do accumulate in that setting.)

14 Will add significant costs to building

Positive / Generally for Whole-house Mechanical Ventilation

1 With the design conditions in our area, pre-conditioned mechanical ventilation is critical to a well designed, energy efficient home.

2 The proof is in application. For the last 10 years outside air brought into the home with a sealed attic directly to the air handler has worked very well.

3 The house preformes well The customer is able to maintain 75 indoor temperature with 45% relative humidity. Also when the fire place runs the propane smell does not come back into the house.

4 used on every home!

Other

1 It was only useful during the cooler months between November and March in south Florida. It was a whole-house fan with a large CFM capacity to pull air through open windows and doors from outside to provide comfortable indoor conditions

2 we use Ultra-Aire dehumidifiers delivering the outdoor air into the return air duct systems, controlled with a Honeywell Prestige-IAQ thermostat that has the ability to control for temperature, humidity, and schedule ventilation with O.A. filtered and dehumidified prior to entering the home.

3 Would like to see hot water recovery. and solar power A/C

4 Cost reflects all energy star testing, reporting and consultation.

5 Exhaust fan method to meet ventilation should have no impact on hvac load or sizing

6 Cost of this change is not available to me at this time, getting pricing on testing for example was from 400 to 1000 dollars just for the test.

7 Testing requirements not clear regarding method of setting controller and taking air flow measurements. Manufacturer's instructions also not clear.

Sorted Comments for Question #51: Do you anticipate that the Florida Code's blower door testing requirement and the associated whole-house air tightness requirement will be beneficial overall?

No or Generally Negative

Moisture / IAQ Concerns

1 To achieve a test rating of no more than 5 ACH50 the structure would be prone to mold growth. by sealing the interior air barrier to the floor would promote moisture wicking from the concrete slab (curing process) into the wall board

2 as noted earlier, the homes are getting to tight and not allowed to breath properly causing the inability to control indoor humidity levels, causing mold problems in many cases.

3 THEY WANT TO HAVE THE HOUSE TIGHT TO SAVE ENERGY, BUT TOO TIGHT YOU HAVE TO FORCE AIR INTO THE HOUSE TO PREVENT HAVING A SICK HOME. DO NOT SEE HOW THIS WILL BENEFIT ANYONE

Cost and Regulation Concerns

1 it will cause too many delays and increase the cost of the homes

2 i think it is government intrusion at its finest. most folks are stretching to buy a home and while i think it is a benefit to offer the service to the client it is not the government's purview to demand this of owners. it drives the costs and can put some people out of the market, lowers the ability of builders to keep costs where they can sell at a profit and still have buyers.

3 A complete waste of money and time.

4 If you keep adding additional testing and additional requirements to building than you drive the cost of building affordable housing for individuals that do not make the salaries that you do! How many people in your everyday activities that work extremely hard for just above minimum wage 40 hrs+ a week that cannot afford to feed their families and provide housing or shelter! Look around they work in grocery stores where you shop, fast food where you by your lunch, dinner, they cut your grass, they work hard but don't have anything to show but a paystub. Trying to save all the energy will not help them up out of poverty or living from paycheck to paycheck. Let's use common sense for a change!!!!!!!!!!!!!!!

5 it is a waste of time and money and unnesesary

6 This is another outrageous mandate that only increases costs and longer build times. If the building inspectors complete their jobs in a thorough manner, to make sure the home is sealed and insulated properly, and the A/C ducts are installed properly, then this test is not necessary.

7 No sufficient energy benefit to justify the cost and potential construction delays is foreseen.

8 Waste of time and money.

9 I say no only because they are building these houses tight to meet buyers demands for lower power/energy bills. We already know most of these homes building components are working in that regard and many are in the 3.x ach50 already. All the testing is doing is verifying but at a added cost.

10 I have not been able to find any proof that the blower door test will make our homes any more efficient. It just adds additional non-value costs.

11 Please define the goals and objectives before wasteful practices and standards are added to the building code. Blower door testing is trying to solve a problem that doesn't exist.

12 Quit adding more expense to home buyers..

13 Lobbyists are constantly causing useless expenses for homeowners.

14 I believe it is a waste of the contractors money, do to the fact that the energy code requires the dwellings to be so tight.

15 It's just the State asking for money! It's Bull crap.

16 Envelope leakage in FL is a waste of money to the homeowner and will become a health issue.

17 another layer of testing/certification possible delays as learning curve of inspectors/inspections being climbed

Not Logical

1 why would you need a tight house when you would have to do air changes?? who ever is coming up with these regulations needs to find work elsewhere.

2 It doesn't make any sense to make a structure excessively tight and then introduce outside air back into the structure.

3 if the house is built so tight you have to use ventilation then you are bringing in the hot humid air the house was built to stop where is the savings

4 As written, the ACH cannot exceed 5. But, if it is less than 5, then outdoor air must be brought in. If that is the intent, then the Code should just mandate outdoor air intake. I do not believe that there will be any energy savings by tightening up buildings so much that there is no natural inflow of outdoor air in which case, then it needs to be brought in mechanically, thus increasing the energy usage for larger AC units, added mechanical fans and dampers. It seems to be a wash of any cost savings in addition to being an unnecessary task for an owner or builder to have done (blower door test).

Cheating Concerns

1 I think that builders will find a way to cheat the system, much like they are already doing in many homes in Alabama. It isn't hard to do, they can do one and past it, then keep changing the name, they can adjust the volume to decrease the ach number. I think many small mom and pop builders will end up paying the price while your large production builders will be allowed to get away with building poorly constructed homes. I think that allowing the builder or HVAC dealer who is working the job perform the testing will be a huge mistake and one that tricks the customer into believing he has this great home, when it may not be.

2 There will be cheaters, plus things will be modified by the owner or re-modelers, that have a great effect. Plus some Sealing Technics or materials won't last many years

3 This is a waste of time and money , a quote from a company We were going to use: "We can adjust the test parameters to get the results needed" So Just like the Load calculations requirements can be adjusted, this will simply add to the cost and the time required without acually affecting the outcome of the building efficiency

Unnecessary

1 This test will not do anything for the safety of the occupants.

2 Today's construction standards are sufficient and I would expect blower door testing would not improve any energy efficiency or public safety issues.

3 The homes we build are tight enough, without needing to prove it.

4 I think that blower door tests could be beneficial, but by pairing it with whole house ventilation, my response is "No, they do not benefit our home buyers". Blower door tests provide proof that our homes are tight, but we already know that they are tight due to building practices that have been added to the FBC over past years. I believe that if the FBC stated that HVAC register boxes are required to be caulked to the drywall, as it says for hi-hats, we would end up with the same result, but with out the extra additional costs for testing.

5 On one hand, if the contractor is responsible and competent, they will have to adhere to the infiltration checklist in FBC-EC table R402.4.1.1. I would imagine that this should be a tight envelop where a blower door test would most likely pass. So what does the expensive blower door test do? It proves that the contractor performed everything on the list or not. Wasn't he supposed to do that anyway? The building department, although not responsible for the construction, inspects from the list. Are they doing their job if the test fails? If the test fails, and the contractor has to fix the problems (that he should have taken care of originally), would another test be necessary? If so, who would pay for it? All in all, I'm not seeing the benefit of passing costs for expensive test, most likely the result of shoddy construction on to the owner. Perhaps this is negligence on the part of the contractor and should be brought to the State's attention.

6 If a home is built to code and the various inspections are completed along the way to ensure that all material is compliant with code and installed property; then, there should be no need to test.

Other

1 Florida building code is a Rube Goldburg, it is a very complicated system to achieve a much simpler goal.

2 Blower door test results are not consistent.

3 Blower door testing is representative only of the house the the exact time. Test will become routine and will only be attempting to do what's necessary to pass the test.

4 Scheduling and delays. Qualified contractors and/or raters

5 Very tight homes in the Florida climate are not neccessarily the best approach for safe and efficient construction.

6 Since the new codes that make these house more tight, has sprung many more problems.

7 home owner consumer not ready or does not understand the impact of this

8 Do not make a rule or code you cannot enforce. This will be such a rule. It has good intentions and can have positive effects. However, it will be almost impossible to implement, enforce, and monitor long term. The simpler solution is requiring all ducts to be installed within the conditioned envelope. This will eliminate the need for a blower door test and is enforceable.

9 House should not be air tight

10 Need the infrastructure to do and not set up yet. Everyone scrambling.

11 nonsence

12 Without oversight I'm not sure how the test results can be trusted.

Yes or generally positive

Provides Verification

1 Code must be enforced equally to maintain integrity. There will be a lot of complaints upon implementing, but it will drastically improve comfort, energy savings, and quality of homes built to compliance.

2 blower door testing is needed, to help verify the builder has assembled an energy efficient home poor home owner has no clue about what a blower door test is, but a leaky home is expensive to operate and uncomfortable - to set a standard like "we are gonna build energy efficient homes in Florida by setting the standards (energy code)" BUT - we are not gonna verify the standards are not actually met? - blower door test verifies the envelope is intact, this envelope has too many layers and is only as good as the workmanship during assembly - all done by people - i can tell you many stories of envelopes so poor, indoor moisture content so high - all due to excessive infiltration, driven naturally almost year long in our region -

3 Getting a 3rd party verifier keeps eveyone in gaged. Often evey one assumes the home is tight however often enough that is not the cases and highier energy usage and comfort issues are the result of poor engagement/ lack of building science understanding.
4 Testing has let all building trades know that they cannot hide mistakes during the building process, resulting in a better final product. "Will we be tested on this?" mentality.
5 Blower door testing really informs the builder and customer of the quality of home they are getting. Houses can look exactly the same but have extremely different infiltration rates. Blower door testing is a way to make sure that all of the sub contractors are performing the proper air sealing that is required by code. Just doing a visual inspection by the nacked eye is like how mechanical contractors used to use the "rule of thumb" to pick HVAC equipment size for house. It just doesn't work.
6 it will verify house tightness and not have to guess
7 When the builder follows the requirements of the Florida Building code, the house will comply with (pass) this envelope tightness requirement. The blower door test results provide proof to the consumer that the builder has, indeed, complied with the applicable parts of the code.

8 IDENTIFICATION AND TESTING IS A QUALITY ASSURANCE STEP THAT IS REQUIRED TO PROVIDE THE CONSUMER WITH CONFIDENCE IN THE ABILITY OF THE BUILDER AND THE TRADES HE EMPLOYS. WITHOUT THIS THERE IS ONLY THE END RESULT OF POSSIBLE FAILURE AFTER THE FACT WITH THE BURDEN ON THE CONSUMER. THIS NEEDS TO END.
9 Quality assurance in new home product should be important.

Improves Quality, Efficiency and/or IAQ

1 Blower door testing will be beneficial and will help eliminate leaks that will eventually introduce moisture. However, I don't think mandatory ventilation should be required unless there is a specific IAQ problem such as moisture or excessive CO2.
2 Air leakage can account for up to 40% of energy loss for a building enclosure. Decreasing air leakage will significantly decrease energy consumption that is required to condition a home. Building that are more air tight limit occupants exposure to pollution and moisture laden air that promotes mold growth.
3 Raises the bar for all builders improving their product for consumers.
4 Essential for energy efficiency, comfort, indoor air quality and to prevent mold in humid Florida.
5 Testing will confirm that houses are built correctly and that HVAC performance will not be compromised by a house that is leakier than expected.
6 you don't know unless you test - establishing lower ACH' swill size equipemtn better. Eventuallu the home is heathier and has lower energy costs
7 It will force builders and subs to think more about the quality of work they are installing. The thermal envelope is usually pretty tight on a new home. The greater problem is actually poorly installed insulation on walls that can only be seen with thermal imaging with a blower door running.
8 Blower door test are great to determine air leakage and infiltration, especially in duck work and overall finish work. They can identify major deficiencies that are otherwise undetectable by the naked eye.
9 tighter home is energy savings and keeps outside air out that has high moisture reducing mold
10 Tightening houses will improve comfort and energy efficiency
11 Prevent Infilitration. Add testing because contractors will do as little as they can at one site to move onto the next one. Make this a requirement, test it and certify it.
12 It has been well documented over the past 30 years in research conducted and by Building America through the US Department of Energy that building a tight envelope is an advantage in energy conservation and the air quality in projects across America.
13 It would be good to have all homes built to improve their efficiency.
14 This will help put better homes on the general market
15 consider the more efficient home will cost the HOME OWNER less during the life of the home.

Other and Multiple

1 I think it is important for the home buyer to have an understanding of both air leakage and mechanical ventillation. Builders who adopt more energy effecient building practices should incorporate more feedback to their prospective clients about the home they may purchase and how it functions
2 The Energy Code requires certain levels and the homes need to be tested to certify compliance
3 job creation, better building practices, less energy waste, third party verification for bulider
4 If you don't measure something, how can you manage it?
5 We add blower door requirements to all our projects in the specifications
6 Yes, because as the energy code requirements get more and more stringent, the homes become tighter and tighter.
7 It is good to test the houses and locate the leaks for repair.

Unclear or Unresponsive

1 Florida certified meeting 2009 ICC but then proceeded to exclude blower door and duct blaster tests

2 Don't want the houses that tight down here but having minimal outside air pressurization by some means would be beneficial (without increasing unit sizing, hopefully). HRV and ERV don't seem to have much value in a residential situation particularly since the FBC already is hinting that homes should be pressurized.

3 The Florida International residential building code has "required" blower door testing since 2010. The way contractors gert around this requirement is spelled out in the code with a note that follows after theblower door requirement: "if the building officials may visually see that the sealing has been performed then they will not require the blower door testing". As a certified home inspector I have recently inspected 3 new homes built in the last year - they were all built by different contractors. Each home was not sealed around the ceiling can lights or the HVAC boots. They also did not have the attic insulation consistently installed, some areas were missing insulation, others were not the required 12.75" deep. The supply ducting in the attic was not the required R-8. That these homes were not sealed in obvious places, who knows about all the covered areas that were required to be sealed?

4 A house would be better if icing was required, then leakage wouldn't be an issue. Another way of increasing energy Efficiency would be to increase the minimum SEER rating of an AC system or heat pump 16 SEER and a two stage compressor. Controlling the humidity in a Florida house is where comfort comes in. A two-stage system will pull more moisture out of a house and allow the homeowner to run the temperature at a higher temp with the same comfot as a house with higher humidity and a lower temperature.

5 That is the wrong question.... this is clearly not a question of science and therefore if it is true it must be false.

6 All Florida homes, especially referring to block construction, even under the previous code will have less than 3 ACH50. I've never tested one over the last nine years over 4 ACH50.

7 houses are being build to tight. thus the reason for this code!

8 It will take time and require attention to details on the installation of components to achieve a well sealed house...along with good design.

9 From past experience from 2005-2007 on 3 story townhouse (230 built with foam insulation in attic) and conducting these test every 20 units (approx) and getting 94% + seal, we had to equip the AHU units with additional equipment to have 40% air intake. The problem encountered having to keep the A/C on at all time. We encountered complaints from new owners who go out of town for a few days ...leaving the A/C off to save electricity...only to come back to their home and find spores on their ceiling and walls resulting in a plethora of complaints. Florida's humid air intake does not solve the problem for air tightness.

10 Demand Manual J designs room by room for ALL homes!

11 At the risk of stating the obvious, the purpose of the blower door test and whole house mechanical ventilation are directly at odds with one another. Requiring both is a classic case of over-regulation. Comparable results can be achieved by requiring proper sealing of the building envelope. If different results are desired, passive options would be the preferred avenue. If the current code requirements are suitable then increased enforcement by building officials is an option that could be considered.

12 Qualifications of Tester?

13 The House are so tight now That they are talking about whole House Ventilation ??

14 See additional whole-house mechanical ventilation related comments.

15 Builder was doing tests but refused to supply homeowners with written results, assured them verbally results were stellar

16 The goals of the new code are understandable. The infiltration of hot, humid air can be severly detrimental to the health of occupants and quality of construction. The additional requirements for whole-house ventilation are also logical -- however, it seems silly in a way to assume that any test (to several decimals) can possibly result in the exact number to avoid a whole-house ventilation system, and for that reason I believe the whole-house ventilation should be required for all new projects that are required to reach the air tight construction.

17 when there is a range to fall within... such as 4.2 to 5.4 for example, not just 5

Sorted Comments for Question #53: Do you anticipate that the Florida Code's whole-house mechanical ventilation requirement will be beneficial overall?

No or Generally Negative

Moisture / IAQ Concerns

1 Increase the run time of variable speed Condensor Units to help reduce interior humidity. Don't bring in humid outside air.

2 the introduction of additional outdoor air just creates more issues to deal with

3 ASHRAE standards that mechanical ventilation when a home is at 5 or 4 is way to strict. If a Florida customer builds the home exactly to those standards they will have moisture homes, with higher utility costs and be uncomfortable. Forcing someone to have make-up air with homes that are this close to 5 does not create a healthy home. HVAC dealers should be made to get better certifications and view a home on a case by case bases to determine if the home needs the make-up ventilation. If they stand by their work, then this should be no problem, and if it goes bad, then the HVAC dealer should be held responsible.

4 the introduction of hot humid air to our homes will be more of a negative than any benifit

5 Adding humidity and moisture to the conditioned environment.

6 Will bring inevitable humidity problems in low and medium priced production homes. Except for the high end custom homes that have sufficient budgets to cover the cost of variable speed AC equipment and/or Dehumidifiers, the problem of Outside Air moisture being introduced into the homes will not be addressed and will cause serious property and health hazards.

7 Bringing warm moist air into a tight home is a bad idea. Over time, the moisture will accumulate in the home and begin to mildew IF the home is not designed to condition that moisture.

8 You are asking for trouble when ever you introduce outside air into a hot, humid climate. HVAC systems need to work much harder. For the most part it is completely unnecessary as most people spend the majority of their time outside of the home.

9 I personally don't feel that whole house ventilation is needed if a home is built to 4-5 air changes per hour. I believe that the threshold should be 3 ACH before a whole house ventilation system is needed. I think that it opens us up to have problems with the indoor environment of our homes, because if it is not done improperly, then problems will definitely occur. And, by making this a code requirement, we're asking a lot of under qualified contractors to install systems that they are not familiar with.

10 Introducing warm, moist air into a conditioned home is not good science. The results speak for themselves. 2 years of installing the mechanical ventilation has resulted in several call backs to address mildew/mold growing throughout the homes in question. Anyone with any common sense knew this would happen, but the engineers and experts knew better...They'd have common sense if they had to build something instead of talk about it.

11 Not a good idea for a high humidity climate

12 I think the negatives outweigh the positives. We will have more mold and moisture issues with decrease in equipment life. South Florida is very humid and hot most of the year. Equipment looks good when the job is complete, but when parts start to fail down the road the homeowner won't fix due to cost and the service company will bypass.

13 Because Florida is humid, outside air, if not brought into the building properly, could cause disastrous problems, especially with mold. I think the judgment of the need for outside air should be left to the engineer. Normal occupancy and use of normal homes logically will tell us that people come and go through doors many times a day. This would seem to provide enough ventilation to dilute any pollutants inside. In addition, bringing in unnecessary warm, humid outside air is extremely expensive to dehumidify properly and could lead to mold, something I don't think is a benefit to homeowners. This should be left a choice to the owners/designers, not a mandate.

14 The problem in Florida is humidity. Requiring more outdoor air to be brought in increases indoor humidity, and increases energy costs. The only reason to require outdoor air systems is because requirements for tighter construction reduce infiltration. In a heating climate it makes sense. In Florida with the example, concrete block with a stucco finish is already a pretty good air barrier.

15 Further study required in high humidity areas (Miami-Dade, Broward, Monroe, etc...) dehumidification (essentially small AC) needed with heat recovery in tight house due to required air changes. Running large AC to cool, and small AC to dehumidify when large AC is off means an AC is running nearly 24/7 in summer. This may result in a trickle of energy savings - overshadowed by flood of upfront cost Without effective dehumidification, buyers will spend more to buy new houses with mold and mildew. We should not rush to enact law which substitutes one problem for another.

16 Mandating ventilation in a hot humid climate is dangerous. To bring in the amount of fresh air specified by ASHRAE 62.2, that air MUST be conditioned. Residential hvac system cannot process that amount of latent load. Therefore the air will have to be pre treated by a commercial grade EVR's. But, the exiting air will be too hot and too humid to distribute in the home. The discharge will have to be processed by the hvac system. Or the fresh air will have to be dried in a commercial grade dehumidifier and then processed by the hvac system. The type of ERV or dehumidifier required would add $3,000 to the cost of a new home. Additionally, the extra sensible load may require a larger capacity hvac system which would add another $1,500 to the cost of a new home.

Not Effective / Not Worth the Cost

1 Watering down chemicals brought in by the homeowners isnt going to help much or at all. Florida's climate is hot and wet and it is making issues. From a health standpoint it would be better to educate homeowners on not brinkng in voc laden furniture, flooring, etc. Filling a house with toxic junk is the issue and watering it down via fresh air isnt the answer.

2 Generally a waste of money. Toilet/kitchen/dryer exhaust can provide that ventilation and has for years without any significant issues. Why fix something that isn't broken.

3 We stop houses from leaking air so we can put mechanical leakage into it for the purpose of job creation and increased cost to the consumer.

4 We just came out of the worst economic down turn for the construction industry every and you want to burden the residential builder even more! Reallyyyyy!!! if you think that money grows on trees and that everyone will just joyously run out and pick some and give it to the builders just because they have no other good thing to think about. WHAT FANTASY LAND DO YOU PEOPLE LIVE IN. GET YOUR ASS OUT OF YOUR IVORY TOWERS AND LOOK AT THE IMPACT YOU ARE HAVING ON THE PEOPLE AND YOU WILL BE DOING A BETTER SERVICE TO ALL

5 I have not been able to find any proof that mechanical ventilation will make our homes any more efficient. It just adds additional non-value costs.

6 These codes off no benefit at all. The mandates of the 15 degree design criteria do not provide a realistic outcome. If it's 95 degrees outside are you willing to sit in a home at 80 degrees?

7 just going to add to the costs and not going to add to energy efficiency ....so why do it.

8 Counter intuitive to energy conservation. I don't see any advantage to it whatsoever.

Other

1 Do not like the idea of bringing in unwanted irritants, noxious odors, smoke etc. from the outdoor air.

2 industry driven

3 They worked well in the homes built a long time ago before a/c. Energy conservation is a life style. I am a Florida GC (CGC 012036) since 1977 AND owned Gale insulaion in Alachua County from 1979 untill we went public in `94. I am building affordable homes in my area now. You can do away with all computer programs both residential and comericial. Just have minimum standards, in my opinion.

4 Blower door testing will be beneficial and will help eliminate leaks that will eventually introduce moisture. However, I don't think mandatory ventilation should be required unless there is a specific IAQ problem such as moisture or excessive CO2.

5 Why would we continue to make the new homes tighter in nature and more energy efficient, then take a huge step in reverse by bringing in unconditioned air from the outside and reduce the energy effeciency we have strived to acheive?

6 They will be turned off to save energy, plus they will not be repaired or replaced when they fail.

7 As a builder of Energy Star and FGBC Cetified GREEN homes for almost twenty years I've seen what works and what doesn't. Additional mechanical ventillation is not necessary and would only be an issue if air leakage is measured and controlled more than it is now. Homeowners are not building scientists and will not understand these systems well enough to monitor their proper performance.

8 THERE ARE BUILDERS THAT ARE NOT GOING TO COMPLY WITH THE NEW STANDARDS OR TAKE SHORT CUTS, THERE IS TOO MANY UNANSWERED QUESTIONS, WHEN WE ASK A QUESTION TO 3 DIFFERENT PEOPLE WE GET 3 DIFFERENT OPINIONS AND IDEAS.

9 We are making the house too tight and then we want to bring in outside air in a regulated manner? We understand the thought process from a committee meeting standpoint, but let's look at it from a reality standpoint of cost, time, and the fact that homeowners don't want it. In a person home, I would be disconnecting the outside air fan.

10 No, why bring fresh air into home from the humid outside in Florida, Allow an option to do spot exhaust and dehumidify the exiting air. Only worry about fresh air if the oxygen count gets lower than 15% or so.

11 Not in favor of more codes or laws

12 I see no reason to add this requirement when we have doors and operable windows (provided they meet the required open spaces for natural ventilation). The idea of forcing hot and humid air into our cool spaces during the summer leads me to believe that condensation will be a factor when this air comes into contact with the cool spaces and this will provide an environment suitable for mold growth. The forced air must be treated and residential equipment is not designed for this. The additional front end costs of the equipment will affect the consumer, and the increased energy costs to treat this air will have a negative impact on the environment. The idea of forcing cold air into the warm spaces in the winter will increase energy costs for the additional electric heat, natural gas, or heat pump operation and the consumption of these fuels will have a negative impact on the environment.

13 To bring in 90 degree Hot Air with 90% Humidity in the Summer sounds crazy to me

14 Most won't be installed properly.

15 Code requires exhaust fans in the kitchen and all baths...this coupled with the fact that people go in and out of there homes should provide fresh air into the home as opposed to having to bring in unconditioned, moisture latent air internally. Perhaps a HVAC system thermostat with air quality measurements and humidity level measurements would circumvent the need for additional mechanical ventilation because it could call the system on as levels indicated the need as opposed to making it run when it's not needed.

16 I have seen the misuse of whole-house mechanical ventilation. The designers do not fully understand its purpose and the builders want it cheap. These are two ingredients in the recipe for disaster. I perform a lot of building evaluations. I have seen more harm than good. I also see that ventilation in our warm, humid climate can be highly overrated. Many buildings function quite well without all the ventilation deemed necessary by the code. One prime example is a church. The church requires a tremendous amount of outside air for a minimal use facility. The cost of the equipment to provide this large quantity of outside air is expensive. I have found churches work very well without all the outside air.

17 At the risk of stating the obvious, the purpose of the blower door test and whole house mechanical ventilation are directly at odds with one another. Requiring both is a classic case of over-regulation. Comparable results can be achieved by requiring proper sealing of the building envelope. If different results are desired, passive options would be the preferred avenue. If the current code requirements are suitable then increased enforcement by building officials is an option that could be considered.

18 Mech ventilation code doesn't consider actual operation / usage of home - all the already-occuring leaks into even a tight home such as by standard exhaust ductwork, doors opened periodically, etc.

Yes or Generally Positive

Needed for IAQ

1 Building tighter and more energy efficient homes requires mechanical ventilation to prevent negative results in home comfort.
2 Mechanical ventillation for tight homes should be a requirement.
3 If properly completed, the indoor air quality would be better.
4 Mechanical ventilation will ensure indoor air quality and that fresh air is coming into the house for residents.
5 The homes are so tight, they need to have ventilation air.
6 Having a tight home is good. But it being too tight that it can't breath isn't. Might as well bring in the ventilation in a manageable quantity, location and be able to filter it.
7 VENTILATION IS NECESSARY FOR A HEALTHY INDOOR ENVIRONMENT. REDUCTION OF CARBON DIOXIDE BUILD UP AND POSSIBLE RADON BUILDUP DUE TO NON VENTILATION OF SPACES CAN BE UNHEALTHY. FRESH AIR IS NECESSARY FOR A HEALTHY ENVIRONMENT AND IN FLORIDA IT NEEDS TO BE CONDITIONED AIR DUE TO OUR CLIMATIC TEMPERATURES.
8 Air quality is important to the home's occupants. Air exchange especially in tighter houses can be an issue for the health of the house. The induction of fresh makeup air insures that both the house and the homeowners will stay healthy.
9 yes, because of the tightness of the homes today, it is preventing the natural infiltration of fresh air in and trapping old, contaminated air to be re-breathed by inhabitants
10 Healthier houses better IAQ
11 Some foamed houses do not have adequate fresh air and it is affecting the health of the homeowners.
12 Following the requirements of the building code results in a house with less tha .02 natural air changes per hour. With no added, controlled, mechanical ventilation, the house will eventually develop moisture problems. It is solely the builder's responsibility to know and follow the code, and hence to know the house requires ventilation.

Other

1 I have plenty of experience with mechanical ventilation from the houses I have worked on. When you use an HVAC contractor or engineer that knows how to design the houses properly for our climate zone. You will have no problems. Most of the home owners that I get to educate about ventilation request it. Florida is not the only state that is in Climate zone 2 we face the same problems as other South East Costal areas do. If they can make mechanical ventilation work for them. We can also make it work for us. Just as I have with my customers.

2 Direct outdoor air into the air handler (when running) would help keep the dwelling at a positive pressure.
3 Only if the ACH50 is below 3.0. (My opinion only)
4 see comment above government overreach
5 SAME REASON AS STATED IN THE LAST COMMENT. IF IT IS CONDITIONED VENTILATION IT WILL BENEFIT THE HOME AND HOMEOWNER, EXCEPT THERE WILL BE NO ENERGY SAVINGS INVOLVED DUE TO THE EXPENSE AND OPERATION OF THE ERV
6 Eventually when all of the bugs and missconceptions are worked out. Initially I see lots of pushback because people and especially builders and HVAC don't see the need.
7 education is key component if every home gets it, regardless of method, the homeowner can decide to use or not letting consumers know there is a system in place to help them ventilate if needed
8 It won't, however, be beneficial to the State as a whole, until older homes are required to comply.
9 On Homes with a low ACH50

Unclear or Unresponsive

1 See my comments written in the Blower Door test question above.
2 This one is going to be tough, often I have seen the wrong size ducts for this and equipment.
3 the humidity that the fresh air vent brings in could cause mold problems if the systems don't have humidity control. the ones that do have humidity control will run longer in order to get the humidity out so you have to have a damper installed to cut off the fresh air duct until the cycle for humidity control is complete
4 BUT! Builder/buyer awareness of proper mechanical ventilation systems is not sufficient. Choosing the least expensive code compliance method will create more public health safety. the amounts of fresh air required through a tight home will create a science experiment inside most airhandlers
5 The standard sealing requirement are enough to satisfy building tightness. There is no need for blower door testing.
6 The basic philosophy of mechanical engineering is to simplify a system. There are ways to test positive pressurization without a full blower door test.
7 only when you build a house that can't breath otherwise no
8 Very tight homes in the Florida climate are not neccessarily the best approach for safe and efficient construction.
9 see comments above
10 I think that the ventilation requirements are cross purposes with the air tightness, which is a glaroing commentary of the lack of agreement within the industry. We need better data on all the above to include costs analysys and impact to restricting access to affordable housing for the future generations.
11 Don't know. Many Florida residents don't ever open windows

12 here in south Florida, humidity concerns and proper control to prevent mold. High cost difficult to explain and justify cost.

13 Tough job in Florida to balance fresh air vs. humidity. ERV is best but too expensive for general use.

14 May or may not be real world beneficial depending on individual circumstances, academically beneficial overall.

15 See above, I combined the remarks.

16 Depends on the house. Some feel smaller houses don't need.

17 BUT- IT MUST BE A JOINT EFFORT OF THE BUILDING SCIENCE PEOPLE, THE MEP ENGINEERS, AND FIELD EXPERIENCED QUALITY ORIENTED HVAC AND GC TYPE INDIVIDUALS. CHANGE IS HARD, IF NOT IMPOSSIBLE FOR MOST PEOPLE, ESPECIALLY THE TYPICAL BONEHEAD IN THE CONSTRUCTION INDUSTRY AND THIS IS PERHAPS THE BIGGEST PROBLEM. PLUS THE RESISTANT "HOW CHEAP CAN I BUILD IT AND HOW MUCH MONEY CAN I MAKE AND TO HELL WITH THE DURABILITY, COMFORT AND EFFICIENCY OF THE FINISHED PRODUCT....NOT MY PROBLEM!!"

Appendix H:

Access Elevator Industry Advisory Committee Meeting Announcement and Agendas

Email Announcement to Committee Members

[This email followed earlier emails deciding on dates and phone calls explaining the project and requesting their participation]

Colleagues

Thank you to everyone who has responded and agreed to participate on this Industry Advisory Group to discuss the cost impacts of a second fire service access elevator in high-rise buildings.

Out first meeting has been scheduled for TODAY, Thursday, October 22, 2015 from 2:30 pm - 4:00pm. Please mark your calendar.

We are setting up the GoToMeeting now but I wanted to make sure you had as much notice as possible.

I will send you another email with the specific computer access and call-in information shortly.

The Group participants will be:

- Rob Vieira Director, Buildings Research Division, FSEC, UCF - Cocoa, Fl
- Sheldon Powell, Gables Development - Boca Raton, FL
- Ralph Hippard, Cost Estimator - Tallahassee, FL
- Bruce Faust, Fire Marshal, Orange County, FL
- Stu Cohen, Architect, Cohen, Freedman, Encinosa & Associates - Miami, FL
- Les O'Bryan, Vice President, Coastal Construction Group – Miami, FL
- Michael Houston, Architect and Builder - Orlando, FL
- Vernet Lasrado, Ph D, Assistant Director, Office of Research & Commercialization, UCF - Orlando, FL
- Sharon Gilyeat, PE, Principal, Koffel Associates - Columbia, MD
- Lauren Schrumpf, Fire Protection Engineer, Koffel Associates - Columbia, MD

I have attached and Agenda and some background research performed by Koffel Associates. See the email from Lauren Schrumpf at bottom of this email and the attached document titled "IBC Code Comparison Table.pdf".

Regards,
Mike Houston
LEED Accredited Professional

IBC FIRE SERVICE ACCESS ELEVATOR CODE COMPARISON					
Requirement	**2009 IBC**	**2012 IBC**	**2015 IBC**	**Comments**	**New Cost?**
One Fire Service Access Elevator	**X (403.6.1)**	-	-	Required in buildings with an occupied floor more than 120 ft above the level of fire department vehicle access.	
Two Fire Service Access Elevators	-	**X (403.6.1)**	**X (403.6.1)**	No fewer than two fire service access elevators, or all elevators, whichever is less. For example if you only have one elevator for the building you only need one fire service access elevator. Required in buildings with an occupied floor more than 120 feet above the lowest level of fire department vehicle access.	X
Fire Service Access Elevator Accommodation of Ambulance Stretcher	-	-	**X (403.6.1)**	2015: Needs to be both a fire service access elevator and be able to accommodate a stretcher.	X
Fire Service Access Elevator Minimum Capacity of 3,500 Pounds	-	**X (403.6.1)**	**X (403.6.1)**		X
Phase I Emergency Recall Operation	**X (3003.2)**	**X (3007.2)**	**X (3003.2)**		
Automatic Sprinkler System		**X (3007.3)**	**X (3007.2)**	The building must be equipped with an automatic sprinkler system. The sprinkler shall have a sprinkler control valve supervisory switch and waterflow-initiating device provided for each floor that is monitored by the buildings fire alarm system. 2009: Prohibited locations consist of elevator machine rooms, elevator machine spaces, and elevator hoistways of fire service access elevators. 2012: Prohibited locations consist of machine rooms, elevator machinery spaces, control rooms, control spaces, and elevator hoistways of fire service access elevators.	
Water Protection	-	**X (3007.4)**	**X (3007.3)**	An approved way to prevent water from entering the hoistway enclosure from the automatic sprinkler system outside the enclosed fire service access elevator lobby.	

IBC FIRE SERVICE ACCESS ELEVATOR CODE COMPARISON					
Requirement	**2009 IBC**	**2012 IBC**	**2015 IBC**	**Comments**	**New Cost?**
Shunt trip	-	**X (3007.5)**	**X (3007.4)**	Means for elevator shut down in accordance with 3006.5 shall not be installed on fire service access elevators.	
Hoistway Enclosure Protection	**X (3007.2)**	**X (3007.6)**	**X (3007.5)**	Refers to Section 708 for exact requirements.	
Structural Integrity of Hoistway Enclosures	-	**X (3007.6.1)**	**X (3007.5.1)**		
Hoistway lighting	**X (3007.3)**	**X (3007.6.2)**	**X (3007.5.2)**	Minimum of 1 ft-candle when the firefighters' emergency operation is active.	
Fire Service Access Elevator Lobby Rated Enclosure	**X (3007.4.2)**	**X (3007.7.2)**	**X (3007.6.2)**	1-hr smoke barrier. 2009: Required on all floors except the street level. 2012 & 2015: Required on all floors except the levels of exit discharge.	
Lobby Doorways Fire Service Access Elevator Lobby Rated Doorways	**X (3007.4.3)**	**X (3007.7.3)**	**X (3007.6.3)**	¾-hour fire door assembly. 2012: Other than the door to the hoistway. 2015: Other than the doors to the hoistway, elevator control room or elevator control space.	
Fire Service Access Elevator Lobby Direct Access to Exit Enclosure	**X (3007.4.1)**	**X (3007.7.1)**	**X (3007.6.1)**	2009: Requires direct access to an "exit enclosure". 2012: Requires direct access to an "enclosure for an interior exit stairway". 2015: Requires direct access to an "enclosure for an interior exit stairway or ramp". Exception through a protected path defined.	
Fire Service Access Elevator Lobby Minimum Size of 150 sq ft	**X (3007.4.4)**	**X (3007.7.4)**	**X (3007.6.4)**	Minimum dimension of 8ft. 2015: Regardless of the number of fire service access elevators served by the same elevator lobby.	
Fire Service Access Elevator Symbol	-	**X (3007.7.5)**	**X (3007.6.5)**		

IBC FIRE SERVICE ACCESS ELEVATOR CODE COMPARISON					
Requirement	**2009 IBC**	**2012 IBC**	**2015 IBC**	**Comments**	**New Cost?**
Class I Standpipe Hose Connection	**X (3007.5)**	**X (3007.10)**	**X (3007.9)**	2009: Required in the "exit enclosure" having direct access from the fire service access elevator lobby. 2012: Required in the "interior exit stairway and ramp" having direct access from the fire service access elevator lobby. The exit enclosure containing the standpipe shall have access to the floor without passing through the fire service access elevator lobby.	
Elevator System Monitoring	**X (3007.6)**	**X (3007.8)**	**X (3007.7)**	Monitored at the fire command center by a standard emergency service interface system meeting the requirements of NFPA 72.	
Electrical Power Supplied by Normal and Type 60/Class 2/Level 1 standby power	**X (3007.7)**	**X (3007.9)**	**X (3007.8)**	2009 & 2012: Features where this is required consist of elevator equipment, elevator hoistway lighting, elevator machine room ventilation and cooling equipment, and elevator controller equipment. 2015: Features where this is required consist of elevator equipment, elevator hoistway lighting, ventilation and cooling equipment for elevator machine rooms control rooms machine spaces and control spaces, and elevator car lighting.	
Protection of wiring or cables	**X (3007.7.1)**	**X (3007.9.1)**	**X (3007.8.1)**	2009: Wires or cables that interact with the elevator must be protected by construction having 1-hr minimum fire resistance rating or shall be circuit integrity cable having a minimum 1-hr fire resistance rating. 2012: Wires or cables that interact with the elevator must be protected by construction having 2-hr minimum fire resistance rating or shall be circuit integrity cable having a minimum 2-hr fire resistance rating.	

From: Lauren Schrumpf [mailto:lschrumpf@koffel.com]
Sent: Friday, October 16, 2015 3:08 PM
To: robin@fsec.ucf.edu
Cc: Sharon Gilyeat <sgilyeat@koffel.com>; janet@fsec.ucf.edu
Subject: Fire Service Access Elevator Research

Good Afternoon,

We have completed a part of the code review and have attached a table summary of the specific requirements spanning the 2009 through the 2015 IBC. We are continuing to collect committee documentation on the reasoning behind why the changes were made. We have also begun to collect some "answers" to questions we are to address. What we have so far, in a very basic format, follows:

a. What is the purpose of having a second fire access elevator in a high-rise building?
   - To facilitate the rapid deployment of firefighters. Firefighters are responsible for assisting in occupant evacuation and fighting the fire. Adding the second elevator allows them to do both tasks, if needed.
   - An additional elevator is not required if the original design contains only one elevator.

b. Are there specific fire cases cited where a second fire access elevator would have saved lives?
   - The tragedy on 9/11 initiated this code change. It has been estimated that approximately 3,000 people were able to evacuate from the World Trade Center using elevators in the 16 minutes before the second tower was struck.

c. Are there any other tangible benefits to having the second fire access elevator?
   - If one fire access elevator is out of service, the other one can still be used.

d. How often does a high-rise fire of this nature occur where a fire access elevator would be used?

e. Are there documented estimates of how much this would cost (design and construction costs) for a new building?

f. Are there any estimates of jobs created/lost due to requiring the second fire access elevator?

g. How much floor area would be required for the second fire access elevator, equipment room, and associated landing on each floor?
   - Fire access elevator lobbies are required at each level other than the level of exit discharge. The area required for a fire

access elevator lobby is 150 sq ft. One lobby can be used for more than one fire access elevator without having to be enlarged.

- Fire service elevators need to be able to fit a 24in. by 84in. stretcher.

h. Are there documents indicating how a second fire access elevator would affect any other aspect of the building design or engineering? Documentation has not yet been found on how a second fire access elevator would affect any other aspect of the building design or engineering; however, the following is known:
   - An additional elevator is not required if the original design contains only one elevator.
   - The building design has to include fire service access elevators that are large enough to accommodate an ambulance stretcher and can hold a minimum of 3,500 pounds.
   - Emergency lighting along the entire elevator hoistway (Lighting may not have to be doubled if it meets the 1 ft-candle requirement)
   - Both Elevators must be continuously monitored from the Fire Command Center
   - Type 60/Class 2/Level 1 standby source of power for both elevators
   - Wiring and cables must be either 2-hr rated CIC or enclosed in 2-hr construction.

1. Review documentation and determine what led to the addition of the second fire access elevator being included or excluded in codes?
   a. Why is it in the 2012 ICC?
      - "To facilitate the rapid deployment of firefighters."

   b. Were there any related code changes accepted for the 2015 ICC?
      - From the 2012 ICC to the 2015 ICC, the requirements of 3002.4 were adopted into the fire service elevator requirements. This means that the fire service elevators need to be able to fit a 24in. by 84in. stretcher.

   c. Why have some cities chosen to have exceptions? Proponents of the delay in Florida cited New York and other cities relaxing this requirement.

   d. What are the main objections to incorporating a second fire access elevator? Cost

Lauren Schrumpf
Fire Protection Engineer

AGENDA FOR FLORIDA BUILDING COMMISSION FIRE SERVICE ACCESS ELEVATOR INDUSTRY ADVISORY GROUP INITIAL MEETING OCTOBER 22, 2015 @ 2:30pm

1. Introductions
   a. Rob Vieira Director, Buildings Research Division, FSEC, UCF --- Cocoa, Fl
   b. Michael Houston, Architect and Builder --- Orlando, FL
   c. Sheldon Powell, Gables Development --- Boca Raton, FL
   d. Ralph Hippard, Cost Estimator --- Tallahassee, FL
   e. Bruce Faust, Fire Marshal, Orange County, FL
   f. Stu Cohen, Architect, Cohen, Freedman, Encinosa & Associates --- Miami, FL
   g. Les O'Bryan, Vice President, Coastal Construction Group – Miami, FL
   h. Vernet Lasrado, Ph D, Assistant Director, Office of Research & Commercialization, UCF --- Orlando, FL
   i. Sharon Gilyeat, PE, Principal, Koffel Associates --- Columbia, MD
   j. Lauren Schrumpf, Fire Protection Engineer, Koffel Associates --- Columbia, MD
2. Project Background and Objectives
3. Review Background Research provided by Koffel Associates
4. Identify Method(s) for Distributing the Survey to the Various Stakeholders
   a. Developers
   b. Architects
   c. Engineers
   d. General Contractors
   e. Cost Estimators
   f. Fire Marshals
   g. Other? ____________
5. Review Draft Survey
6. Schedule
   a. Final Survey
   b. Issue Survey
   c. Compile Responses
   d. Next Meeting
7. Other Discussion

October 23, 2016 Follow-up Email

Colleagues,

Thank you for your participation in the call yesterday. The industry perspective and your comments and suggestions were quite helpful.

I have attached a revised survey "Elevator Cost Survey 10-23-15.pdf" for your review and comment. Please ignore any formatting issues and focus on the wording of each question. Also provide us with any additional questions you feel need to be included in the survey.

Please return your comments to me by Tuesday, Oct 27 at 5pm EST.

Thank you for your time and assistance.

Appendix I:
Access Elevator Survey Instrument with Logic

Fire Service Access Elevator Impact

[Note: text with blue background below indicates survey logic used to determine which questions respondents see based on previous answers; this text is not visible to respondents.]

HIGH-RISE BUILDING DEVELOPMENT AND CONSTRUCTION PROFESSIONALS:
As you may be aware, the Florida Building Code (Fifth Edition Building) had language that required a second fire service access elevator in new buildings taller than 120 ft with two or more elevators (Section 403.6.1 Fire Service Access Elevator). Prior to this edition of the code, only one fire service access elevator was required. The Florida legislature delayed this code requirement for one year in order to further study the requirement. The Florida Building Commission is conducting this survey of High-Rise Building Development and Construction Professionals to identify the economic impact of this code provision in order to determine if any changes should be made to the Code in the next code cycle. One of the key variables in determining the potential economic impact is the additional construction costs (if any) of incorporating a second fire service access elevator as well as the potential benefits.

The University of Central Florida, under the direction and funding of the Florida Building Commission is collecting input about the cost and other relevant factors thru this survey. The survey is designed to be anonymous. To report problems or malfunctions in the online survey, please contact Wanda Dutton at UCF's Florida Solar Energy Center at 321-638-1430. The survey will be saved with each question completed. You may return to the survey at a later date on the same computer. The survey will time out one week after you start or at the Nov. 20 deadline for survey completion. Thank you for taking the time to complete this survey and for providing us with your insight and experience.

Part I –About Your Business

I am a (an):
- ❑ Architect
- ❑ Civil/Structural Engineer
- ❑ Cost Estimator
- ❑ Developer
- ❑ Elevator Manufacturer/Installer
- ❑ Fire Protection Engineer
- ❑ General Contractor
- ❑ Local Fire Emergency Professional
- ❑ Mechanical/Electrical Engineer
- ❑ Other ____________________

Florida counties you typically serve:

The remainder of this survey concerns new commercial Code (120' or above) construction.

Part II – Experience with Fire Access Elevator Installations

Approximately, how may high-rise projects (ten stories or higher) have you been paid to work/consult on?

Have you ever helped design, build or specify a fire service access elevator for a building?

- ❍ Yes
- ❍ No

If No Is Selected, Then Skip To Do you anticipate the Code's 2nd fire...

If yes, approximately how many fire service access elevators have you designed/constructed?

Have any of your projects had more than one fire service access elevator?

- ❍ Yes
- ❍ No

Answer If Have any of your projects had more than one fire service access elevator? Yes Is Selected

If yes, why were they equipped with more than one fire service access elevator?

Part III – Estimated Cost and Comments

Please provide an estimate of additional cost for a new project for which planning is just beginning. The project calls for three elevators for a 12-story office tower with interior lobbies and corridors. Under Florida 2010 code, one elevator would be required to be a fire-service-access elevator and the other two could be non-fire-service-access elevators. Under the 2014 Florida code language (the part delayed by the legislature), there would need to be 2 fire-service-access elevators for this project.

For this project then, what is your best estimate of the additional cost ($) for making a second elevator fire-service access compliant (assume it is being served by the same lobby as the other fire service access elevator)? Enter numbers only - no $ or comma or % signs.

Comments on the above cost:

Are there any other factors that would warrant an increase or decrease in your estimate?
- ❑ Increase ____________________
- ❑ Decrease ____________________

What if there was another 12-story project being planned with one passenger elevator (a fire service access elevator) and one service/maintenance elevator serving a different lobby. What would be your estimate of the additional costs to convert the service elevator lobby into a fire service access elevator lobby? Enter numbers only - no $ or comma or % signs.

Comments on the above cost - please list those factors that would provide much of the cost you estimated in the previous question.

Are there any other design situations where the two fire service access elevators would be separated and would therefore require a second fire service access elevator lobby?

If the code already required two fire access elevators at the time a project begins, how often would a second lobby for a fire service access elevator be required for your typical projects (estimated % of projects requiring an additional fire service access lobby)? Enter numbers only - no $ or comma or % signs.

Part IV – Most Recent Experience

We now want to ask about your most recent fire service access elevator installation in new construction (not retrofit). Even if this last job is not typical, please answer about this last job. Please do not provide the job name, address or other identifying information.

What was the approximate additional construction cost ($) to make the elevator(s) fire service access compliant? Include all associated construction costs. Enter numbers only - no $ or comma or % signs.

What was the approximate total building project cost ($)? Enter numbers only - no $ or comma or % signs.

How many stories was the structure?

How many fire service access elevators were installed?

How many total elevators were installed?

How many fire service access elevator (elevators) were in the original design for this structure?

What type of corridors were provided?
- ❍ interior
- ❍ exterior
- ❍ both

What type of expected use was the building?
- ❍ Residential
- ❍ Retail/Office
- ❍ Mixed: Residential and Retail/Office
- ❍ Other ____________________

What was your role on this project?
- ❑ Architect
- ❑ Civil/Structural Engineer
- ❑ Cost Estimator
- ❑ Developer
- ❑ Elevator Manufacturer/Installer
- ❑ Fire Protection Engineer
- ❑ General Contractor
- ❑ Local Fire Emergency Professional
- ❑ Mechanical/Electrical Engineer
- ❑ Other: ____________________

What is the status of this project?
- ❍ In design/finance phase
- ❍ Permitted but construction has not begun
- ❍ In construction
- ❍ Occupied

Part V – Future Plans

Now we'd like to ask about your anticipated future fire service access elevator installations.

Based on your experience, what factors have a significant impact on the additional cost of making a second elevator a fire service access elevator assuming it was planned from the design stage (check all that apply)?
- ❑ the increased size of the elevator to accommodate a stretcher (stretcher size 24"x84")
- ❑ adding two way communications connected to the fire command center
- ❑ incorporating additional electrical requirements
- ❑ incorporating the emergency generator requirements
- ❑ incorporating additional structural requirements for the hoist way
- ❑ Other: ____________________

Do you anticipate the Code's 2nd fire service access elevator will be beneficial overall?
- ❍ Yes
- ❍ No

Do you have any specific concerns about the requirement?

Additional Comments:

Thank you for your help!

Appendix J:
Access Elevator Survey Instrument Summary Report

My Report

Last Modified: 11/23/2015

1. I am a (an):

#	Answer	Bar	Response	%
1	Architect		112	34%
2	Civil/Structural Engineer		3	1%
3	Cost Estimator		8	2%
4	Developer		11	3%
5	Elevator Manufacturer/Installer		9	3%
6	Fire Protection Engineer		16	5%
7	General Contractor		115	35%
8	Local Fire Emergency Professional		2	1%
9	Mechanical/Electrical Engineer		30	9%
10	Other		40	12%

Other
ac contractor
Fire Protection Building Code Consultant
HVAC commissiong Firm
A|\C Contractor
Construction Administrator / Owner's Agent
Refrigeration/HVAC contractor, LLC / sole proprietor business
General Contractor
Operations Manager
State certified mechanical contractor
Building Code Official
Elevator Inspector
Code Official
Structural steel fabricator and erector
Fire alarm contractor
USDA Resident Inspector
Elevator Consultant
building code adminsitrator
Building Official
Facilities manager
Fire Alarm Contractor
Elevator Inspector
Mechanical Contractor/ Test and Balance Contractor.
Building Offciial
BUilding Official
Mechanical Contractor
Elevator Inspector
General Contractor
Building Official
Building Official
wonderful
cmc
HVAC Contractor
Mechanical Contractor/ fire sprinkler
Mechanical Contractor
building official
Contractor

Statistic	Value
Min Value	1
Max Value	10
Total Responses	327

2. Florida counties you typically serve:

Text Response
Miami-Dade, Broward, Palm Beach, St Lucie, Indian River, Brevard, Sarasota
Miami Dade, Broward, Orange
maricopa
Sarasota, Manatee, Charlotte
Duval
Lake, Sumter, Orange, Seminole, Osceola, Pinellas, Sarasota, Charlotte, St. John, Duvall, Palm Beach
Escambia, Santa Rosa, Leon, Alachua, Duval, Hillsborough, Pinellas, Pasco, Polk, Manatee, Sarasota, Charlotte, Lee, Collier, Dade,Broward, Palm Beach, Oceola, Orange, Seminole, Brevard, Volusia, Lake, Marion
Miami-Dade, Broward
Duval,flagler,Dade ,broward
Entire State of Florida
Dade
Orange, Duvall, Broward, Dade
All
All
All of Southeast United States, All of Florida.
Broward, Dade, Palm Beach, Monroe, Martian
Sarasota
Dade
Palm Beach
High rise
Escambia and Santa Rosa Counties
Palm Beach, Broward, Dade, Orange
3
Dade, Broward, Monroe
Dade, Broward
Orange, Lake, Volusia
Florida panhandle primarily
Miami-Dade Broward
Lee
dade
Jackson, Washington, Bay, Santa rosa
Miami Dade, Broward, Palm Beach, Monroe
Palm Beach Broward
Lee county and Collier county
Martin
Statewide
Dade
Brevard...indian river w palm Volusia
Miami-Dade
Dade, Broward, Collier and Lee
Miami Dade
Broward, Miami-Dade, Palm Beach
BROWARD
Orange, Seminole, Volusia, Brevard, Dade, Osceola, Disney, Polk, Lake.
ALL
Miami-Dade, St. Johns
Pinellas, Manatee
Hillsborough, Pinellas, Manatee, Pasco, Polk, Citrus,
Sarasota, Manatee, Charlotte, St Lucie
Escambia, Santa Rosa, Okaloosa, Walton, Bay
Broward, Dade, Palm Beach, Orange, Lake, Pinellas, Hillsburough

All
all and any
State wide
Dade, Broward, Palm Beach
Orange
Martin, St. Lucie, Indian River
Broward, Dade, West Palm, Lake, Desoto, Sarasota, Hillsborough, Orange, Pinellas
I'm retired but have continued my mechanical license. The real problem is that lobbyists have created way too many regulations surrounding the fire code. My wife and I own a commercial building and the requirements of the fire code cost us almost $2,000 per year. Two phone lines is a complete waste of money. The other major issue is the quarterly fire inspections. The last thing that will happen is a sprinkled building burning down. The odds are much more favorable that flood damage will occur from the sprinklers running until the manual valve is closed. It's time for our law makers to stop enacting regulations that fill the pockets of fire protection companies. A little common sense would suffice when considering the outrageous regulations that already exist. When was the last time a sprinkled building burned down?
Duval
Miami-Dade County
Escambia, Santa Rosa, Okaloosa
Monroe, Dade, Broward, Palm Beach and Martin.
Collier, Lee, Charlotte, Sarasota, Hendry
Hillsborough
Palm Beach.
Broward, hillsborough, dade, multiple others
SEMINOLE
Miami-Dade, Broward, Palm Beach
Miami Dade and Broward
All
Putnam
Orange, Seminole, Polk, Osceola, Miami-Dade, Broward, Volusia, Lake, Palm Beach, Brevard, Indian River, Monroe, Lee, Sarasota, Hillsborough, Pasco, Pinellas, Flagler, St. Johns, Duval, Alachua
Orange, Seminole, Osceola, Volusia, brevard
Okaloosa, Santa Rosa, Walton
Broward, Martin, Palm Beach, Dade
Polk and Brevard
Pinellas, Hillsborough, Orange, Polk, Sarasota
Hillsborough, Pinellas. Manatee
lee, collier
any
Broward
Orange
Brevard, Orange, Osceola, Seminole
Miami-Dade Broward Monroe Palm Beach
lee county
Miami Dade, Palm Beach, Broward
Na
Pinellas, Hillsborough
Dade
Miami-Dade, Broward
Miami Dade, Broward County
Manatee
Brevard, Broward, Orange
Orange
Duval, Nassau, St Johns, Baker, Clay, Flagler, Union Putman, Bradford, Columbia, Volusia
Miami-Dade; Collier; Broward.
Duval, Nassau, St Johns, Clay
Dade, Broward, Palm Beach, Hillsborough, Orange, Pinellas, Bay, Brevard
Dade and Broward
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	239

3. Approximately, how may high-rise projects (ten stories or higher) have you been paid to work/consult on?

Text Response
6
25
50
30
2
2
5
4
3
12
1
5
0
1
0
50
50
2
15
5
5
25
4
4
4
6
0
15
5
4
12
1
0
6
20
2
10
2
6
3
20
3
3
4
2
0
4
12
4
0
15

15
2
5
0
10
30
5
20
10
2
1
0
20
4
10
50
4
6
50
4
0
5
6
0
0
10
3
6
3
0
10
0
10
0
0
30
500
0
10
1
20
10
2
25
12
4
6
4
8
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	260

4. Have you ever helped design, build or specify a fire service access elevator for a building?

#	Answer	Bar	Response	%
1	Yes		127	49%
2	No		133	51%
	Total		260	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.51
Variance	0.25
Standard Deviation	0.50
Total Responses	260

5. If yes, approximately how many fire service access elevators have you designed/constructed?

Text Response
12
2
12
1
1
2
50
50
15
25
6
5
15
1
1
1
2
4
4
1
15
100
3
10
15
2
10
3
3
6
8
1
12
2
1
5
1
26
3
1
3
2
2
15
3
13
1
100
1
10
5

1
100
5
1
2
40
9
1
8
25
2
30
2
6
2
2
2
15
0
765
1
4
1
6
3
20
20
1
6
15
4
1
5
5
2
8
20
3
20
100
20
1
2
0
40
4
12
5
1
This table has more than 100 rows. Click here to view all responses

Statistic	Value
Total Responses	109

6. Have any of your projects had more than one fire service access elevator?

#	Answer	Bar	Response	%
1	Yes		36	31%
2	No		81	69%
	Total		117	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.69
Variance	0.21
Standard Deviation	0.46
Total Responses	117

7. If yes, why were they equipped with more than one fire service access elevator?

Text Response
Elevators have regular service schedules taking them out of service, and is why most high rise projects have more than one elevator anyway. Allowing them to serve as fire service elevators as well is not a great effort or expense. It also qualifies for underwriter relief, financially.
2012 IBC requirement
to meet code
because the 2012 IBC required it to be installed in accordance with the high rise provisions greater than 120 feet.
Egress requirements based on occupant load and stair seperation
Large building
The international building code requires this in section 406.6.3....and all states that utilize this code have this requirement.
due in anticipation to the new florida building code
They followed the 2012 IBC
They were located in states that follow the 2012 International Building Code, which requires two fire service access elevators per Section 403.6.1 Fire service access elevator.
Adhere to IBC code requirements.
Using the 2015 edition of IBC
Building split into multiple separate sections. These sections were not servicible from one single fire service access elevator. Provided one fire service access elevator to each separate section. Fire equipment too heavy to drive on elevated decks to front of building where fire comand room resided. Required to provide fire service elevator to transport fireman and equipment to fire command room at elevated deck.
The building was separated.
Requirement of 2012 IBC
code required two
ACHA State requirements
Because the size and high of the building
Jurisdiction requirement
Building was already set up with vertical circulation for staff separate from public and visitors. Or separate vertical circulation for prisoner vs. the public.
Redundancy
Owner requirement
life safety trumps budget!
OCCUPANCY NEEDS
Plenty of them
Due to building access and layout
code required it. for building 120' or more.
Hyde Beach, Brickell City Center, Paraiso Bay
It only makes common sense. All other building services have redundancy
Code requirement
yes, many were designed in accordance with 2012 IBC
Hospitals
Several banks of units
Yes
Floor plan layouts with multiple unconnected cores, required one fire service elevator per core.

Statistic	Value
Total Responses	35

8. For this project then, what is your best estimate of the additional cost ($) for making a second elevator fire-service access compliant (assume it is being served by the same lobby as the other fire service access elevator)? Enter numbers only - no $ or comma or % signs.

Text Response
120000
25000
500000
100000
220000
60000
500000
15000
300000
68000
82000
800000
40000
0
24000
15000
120,000
150000
10000
50000
50000
3000
15000
350000
250000
120000
40000
190
20000
0
325000
96,000
24000
4200
21000
125000
10000
100000
25000
30000
125000
250000
0
25000
24000
12000
0
150000
200000
0

240000
556000
275000
500000
100000
360000
1000000
40000
425000
50000
25,000
150000
12000
5000

Statistic	Value
Total Responses	64

9. Comments on the above cost:

Text Response
Typically see about a 21% cost increase in elevator and shaftway construction.
The extra fir access elevator itself is not the issue, its the required stair for the fire elevator access lobby.
area lost to access to fireman vestibule and fire stair on every floor of the building
High
Assumes single speed hoistway doors with baked enamel finish.
to upgrade 2nd elevator to fire rated
The additional cost is due to having area of refuge for the 2nd elevator. In addition to the cost of the 2nd set of elevator doors the building would need to designate a minimum of 150 sf/floor for each floor. Using current construction costs we would estimate that the total project cost would be $500,00 at a minimum. It could be higher due to the configuration necessary to accomplish this code requirement.
Not Sure. No relevant Experience
not involved with the cost but it is significant because generator size increases and if designed under the 2012 or 2015 IBC the provisions of the code required a significant amount of additional construction to comply with 3007.
The additional costs reflect the upsizing of the structural shafts, the platforms, the electrical and air conditioning loads, the loading requirements for the elevators, the notifications and controls modifications for the operations, the reporting and notifications wiring, additional emergency power capacity and duration, additional fuel storage capacity, additional floor area requirements for generator, fuel tanks, elevators size increases.
This is just for added electrical costs only.
None
Increases elevator controls cost, size and cost of emergency generator, communications equipment in the elevator
larger generator, lights inside the shaft, additional fire alarm, additional elevator cost, shaft accommodations to
Due to the requirements to provide accessible means of egress, I believe the extra fire service access elevators need to be provided. While having people carry the disabled down the stairs, most people are loathe to leave their wheelchairs. Providing the extra protection via a Fire Service Access Elevator or an Occupant Evacuation Elevator with communication features for waiting residents seems like the new higher bar which needs to be included in buildings hitherforth. (akin to how stairs were "made" to be 44" wide and have 7" riser/11" tread requirements compared to the 24"-36" stairs with 8" r/9-10" treads! MAJOR change to the construction industry).
Require subcontractor bid
there are many variables but in a building of this size the cost is nominal.....you already have the systems for one required so it it just a operational issue with some electrical costs.
hard to break out exactly
Based on additional parts and labor for the conversion.
Cost is based on additional square footage required for elevator and additional size of generator to run 2 elevators. The equipment cost would not change dramatically.
Uses common shaft and emergency gen load shedding for power requirements.
the costs of the additional elevator requirements are detrimental to developers and building construction. In many cases projects will be scrapped due to the limitations of the site and the lack of feasibility and constructability of typical buildings. Small sites which are now being developed will not be able to be constructed therefore making them undesirable to developers.
Assumes floor plan changes required to maintain lobby to both fire service elevators, added generator capacity for two elevators, added A/E design fee due to increased complexity
Assumes common machine room and all three elevators and their related equipment are able to run on the planned emergency power source. Need to add hoist way lighting and some additional elevator controller functionality to the second fire-service access elevator.
A lot depends on the number of stops this cost is $145k for elevator + $45k.for lobby.
There is also additional lost revenue due the larger cab size reducing the rentable floor area.
There is minimal cost associated with this, as the second fire service access elevator will typically occupy the same hoistway as the first, therefore the requirements of the hoistway (lighting, structural integrity of hoistway) are already included in the project cost. The only other requirement is that the second fire service access elevator be at least 3,500 lbs capacity, however this is a very common elevator size that is frequently used regardless of if the elevator is used for fire service or not.
Code Consultant. Not dealing with costs.
Assume additional 8,000 per stop to one of the already specified elevators.
All building elements are already in place for the 2nd fire service access elevator. There is minimal cost to install the second fire service elevator utilizing the same hoistway, lobbies, etc.
Individual power, controls
In addition if the fireman's lobby on each level has to increase in size to have two elevator doors open into it - then lost rentable sf results which likely is a bigger impact long term than the up front capital cost increase
The direct cost for the elevator operation is only part of the costs. Lobby access & other changes to comply will affect the cost depending on the level of solution.
Cost also includes upsizing of generator to operate the added elevator.
The additional cost does not compare to the lifesaving benefit for human life.
Additional work etc
No high rise designs on table at this time
Guesstimate only
It has been too long since I did this work to give a reasonable estimate of cost, but there is no doubt it will be a 2000 - $5000 minimum add . Since most of the work involves specialty contractors, call Otis, and Miami Elevator, they could best determine internal equipment cost and labor.
the bulk of the cost is in control modifications, cabling and signaling devices.
cost is for elevator control software and additional apparatus in machine room as well as additional key switches and related hardware.

the major impact of cost, if I understand the scenario, is mostly the extra square footage to access the stair.
The cost above is meaningless. as it will vary widely depending on building type. A reletivel modest of 10-15 stories residential tower with a single bank of elevators, light loads may be able to adapt a normally passenger elevator at relatively small cost. A high rise office building with 30 or more stories with multiple el;evator banks would generally have low rise and highridse banks of elevators serving only some floors. A single freight elevator serving every flor is generally provided and also serves as the Fire Service elevator.. In that situation adding a second fire service elevator would be very expensive requireing an additional set of machinery.
20000 per stop
Mechanically, unless an additional elevator is provided no additional cost is anticipate.
Larger elevator, enclosure with access to a fire stair, fire communication, additional fire riser. That's a lot for a 120' building.
This is a variable and could go much higher or lower based on type style and required space that is needed and space that will be lost to revenue. This is however a very needed aspect. Safety should always come first with out any regard for cost. How much is 1 life worth. I can't even believe there is a survey on this. Just do it!
It is determined by height of building cost is based on each stop. 30 k per stop or floor, also the cost of building structure needs to be added
This would require more sensors and communication systems which would increase the risk of system failure in the event of a major event. To limit the risk it would require 2 completely different system all the way to the fire control room. But there is no real way to have 2 "completely" separate systems. Ask yourself why do we have fire inspection annually? to insure the system is operational, The system in the high rises experience sensor and communication failure far more than any other component. Yet this code change only increase the likely hood of communication errors by doubling the sensors and communication systems into one monitoring system. Meaning in a major event the system would shut down both elevators and the operator in the fire control room couldn't keep up with the override protocol or procedure to keep them working in a major event, thus putting first responders at risk.
The cost of adding additional emergency power, wiring, control, etc. is more but manageable, the real issue to us in the design of high-rise buildings is that these two fire-service elevators must enter into a fireman's elevator lobby that is required to be connected to one of the buildings fire stairs. Along with the requirement that mandated two fireman's elevator the IBC also relaxed or changed the dead-end corridor requirements. The planning implications of this are huge. For example, Under the "old' Code,for a rectangular residential high-rise building, we would typically run a corridor down the middle, put a stair at each end of the corridor (to restrict the dead-end distance to 20 feet) and put the elevators in the middle. We might have one, but not two service elevators in a separate elevator vestibule. Under the "new" Code, the elevators, which were typically located in a more central location to the building "migrates" toward one of the ends so it can connect to one of the fire stairs. The dead-end corridor gets longer (Up to 50 feet is allowed) NFPA has allowed a longer dead end distance for some time.
This issue is more complex than simply additional fire access elevators. The code also requires that the fire access elevator lobby have direct access to a fire stair, this is the bigger issue. Typically, the elevator lobbies want to be in the center of the floor to serve occupants equally and the exit stairs at the third points for egress. If you try to use the passenger elevators as fire-service elevators it requires that the lobby to be moved off center and attached to an exit stair. This may compromise the usability of the floor. Typical preferred passenger elevators are 3500# with center opening doors. To double as fire-service they need to be side opening (not preferred) or 4,000#(added cost) cars to accommodate a stretcher. A 12 story building would probably have a dedicated service elevator that could also function as a fire-service elevator located adjacent to one of the fire stairs. The proposed second fire service elevator and expanded fire service elevator lobby are added cost. $300,000 for an additional fire-service elevator and $125,000 for the addition gross building area for the increased fire-service elevator lobbies(12).

Statistic	Value
Total Responses	51

10. Are there any other factors that would warrant an increase or decrease in your estimate?

#	Answer	Bar	Response	%
1	Increase		34	97%
2	Decrease		18	51%

Increase	Decrease
Type of shaftway construction as base to estimate: increase shaftwall, for example.	Base spec of elevator might provide more functions required, and thus reduce cost of increase.
Its the extra stair that serves the required fire access elevator lobby that really adds cost, approximatley 10,000 per floor	
on a 50 story building the problem is exponential	
too many inspection and building restrictions	
Upgrade hoistway door finish Change to two speed or biparting	
Size of elevator	Size of elevator
No	No
in structural, electrical, mechanical, elevator, controls and long term monitoring costs.	in available leasable floor area
0	0
Fire proofing and sprinklers or lack thereof in building. Proximity to first responders.	See above.
use	height
No infrastructure present, electrical etc.	Present infrastructure and its only a function of software.
Depending on the footprint of the building, if the elevators were required to be in different shafts, not serving the same lobby.	
separate shaft, independent generator loading	
building conditions	
If the planned emergency power source is only capable of running one (1) elevator at a time, would need to increase the size of the generator.	Not much to decrease based on the assumptions made.
If the non-fire service access elevators were 2,500 lbs capacity there would be a cost to change the elevator in question to 3,500 lbs and increase the hoistway size.	n/a
Small units\ cores thus multiple cores adds additional second cores.	
a modification to the building footprint which would add gross area to the project's scope	
If location of fire service elevator does not allow 'direct access to a fire stair', additional cost may be realized if it is needing to be relocated.	
If the 2nd fire access elevator had to be in a separate core that would have a significant cost increase	If the 2nd elevator did not have to be enlarged - so stays a standard passenger cab size
Labor. Materials	?
Local labor market, material cost	Local labor market, material cost
These contractors are hard to get to the jobsite and that usually delays the project and therefore increases OHD.	
generator requirements	
Actual configuration of the elevator lobby in relation to the stairs. Extra elevator cab doors.	Actual configuration of the elevator lobby in relation to the stairs.
High rise office building with multiple banks of elevators serving diffferent ranges of floors	A single bank of elevators serving all floors.
Alarm and Sprinkler design	
Increased inefficiency in the floor plate will put this building at a market disadvantage to a similar building	
100000	0
height of building, area to be added to building volume, structure is also an added cost	
the higher to goes the more reinforcement it needs	
There is also a very confusing requirement about preventing water into the fireman's vestibule, that adds cost. Only one of the elevators is required to be stretcher capable.	Only Adds
	Slight decrease due to blanket prohibition of any sprinkler protection in machine room or hoistway serving fire service elevator

Statistic	Value
Min Value	1
Max Value	2
Total Responses	35

11. What if there was another 12-story project being planned with one passenger elevator (a fire service access elevator) and one service/maintenance elevator serving a different lobby. What would be your estimate of the additional costs to convert the service elevator lobby into a fire service access elevator lobby? Enter numbers only - no $ or comma or % signs.

Text Response
150000
25000
400000
100000
60000
500000
15000
200000
68,000
85009
80000
70000
0
21000
60000
50,000
150000
7500
100000
20000
300000
500000
100000
250000
60000
40000
45
10000
150000
275000
43,000
24000
9000
50000
25000
100000
25000
30000
80000
150000
150000
45000
50000
11000
0
150000
50,000
0
240000

245000
150000
350000
100000
500000
100000
225000
50000
200,000
50000
10000

Statistic	Value
Total Responses	60

12. Comments on the above cost - please list those factors that would provide much of the cost you estimated in the previous question.

Text Response
Typically, service and freight elevators require slightly greater upgrades to meet requirements.
I estimate the wiring and controls as constituting the cost increase The cost estimate does not ibnclude the cost of adding another stair which is probably 10,000 per floor
area lost to access to fireman vestibule and fire stair on every floor of the building
Assumes upgrade to fire rated enclosure and lobby doors.
Equipment rooms in different areas
The additional costs would be the same because we only took into account the 150 sf requirement, which is necessary for each elevator.
Not Sure. No relevant Experience.
All costs listed in example one would still be incurred except perhaps the structural component as the service elevator should be large enough to act as a fire service elevator.
This is just for added electrical costs only.
The same approximate costs are involved as the first case
may need to replace generator if both elevators need to work at the same time as fire service elevator
Adequate communications for notification of presence of people.
Requires a subcontractor bid
A completely separate shaft would require many other costs......however it is not realistic to think that a 12 story building could function with only one passenger elevator.......thus this question should not be considered.
Many factors are involved including the fire rating of all interior finishes currently within the building, coverage of sprinkler heads, length of pathway, exterior access for first responders
distance from primary elevator and equipment room
Mostly software related costs
The cost is only for the cost to upgrade the generator to carry the additional load and the associated transfer switches and wiring.
New stairway required for fire service elevator or rated connection to common stairway.
One new complete elevator and shaft.
Floor plan reconfiguration to have stairwell immediately accessible from each elevator lobby, increased generator capacity, additional A/E design fee
Converting to fire rated lobby enclosure walls and doors. Provided fire rated protection of wiring and cables for the second elevator that are not in the wire bundle for the first elevator. Lobby size may be larger than planned if not a fire-service access elevator, which may drive a higher cost impact than estimated above.
This cost is to prepare the lobby area, doors, etc.
The service lobby must become larger to be a fire service elevator and it must be connected to a stair.
This is a rough guess for the cost of a 3,500 lbs capacity elevator with 12 stops. Note however that it would be very unusual to only have 1 passenger elevator in a 12 story building.
assuming lobby is sized adequately as planned, the additional cost is associated with equipment and controls
Assume $4,000 per lobby to provide wall ratings, dampers, com equipment, etc.
Controls and power are already separate. Just have to bring emergency power supply.
lower cost than first option - however this will cut into leasable SF. Also if the fire lobby has to tie to a exit stair then this cost could go up substantially as the service elevator may not be located where the fire stair needs to go - and that could lead to the need to add another exit stair - more cost - more lost lease space
Added fire resistive rating, emergency power and water protection. Added door to stair from the lobby
I have assumed about 8,500/fl to select some level of solution.
Costs center around elevator controller modification, elevator standby power selection, added switches and cabling for fire control. Upsizing of emergency generator to provide constant power.
not significant
□
Location, power, structure and constructability
Contractor availability, Signage, Elevator control panel changes.
Fire-rated wall and door construction to separate the proposed elevator lobby from the adjacent space(s).
new lobby fire station, in-car fire controls. Cost of additional retro fitting of the control board.
Same as before.
These estimates are generally meaning less. The above scenario offers the easiest adaptation.
Size of lobby , egress lenght, emergency lighting, sprinkler, alarm design
Again no additional cost is anticipated.
Air plenum
See above
It would be minimal just changing the controls system
The most costly thing to do in a high rise is run more conduit and wire
This requires an architectural solution. First, what will most likely happen in the above scenario is that the service/maintence elevator lobby will be deleted. There will only be ONE Lobby for firemen and public which is allowed, but not as desirable. This elevator lobby will connect to one of the fire stairs. The cost estimate above is to redesign the one

passenger elevator with a front and rear door with the back door opening up to the fire service elevator lobby and the front door opening up to the passenger lobby. This is expensive.

The code requires that fire-service elevator lobbies have direct access to an exit stair and a minimum lobby size of 150 SF . To minimize cost the service elevator/fire-service elevator would attach to one fire exit stair and the passenger/fire-service would attach to the other. This is not optimal planning for users. Separating the the two fire-service elevators doubles the fire-service lobby SF requirement($225,000). The typical 3500# passenger cars would need to be side opening (not preferred) or all increased to 4000#(added cost). The off center location of the passenger elevator lobby may be detrimental to marketing the building. If

Statistic	Value
Total Responses	48

13. Are there any other design situations where the two fire service access elevators would be separated and would therefore require a second fire service access elevator lobby?

Text Response
Not really, no.
If you didnt want to adda third stair in the middle of the building to service two fire access elevators then you could place the 2 required levators at each end of the building adjacent to the stirs and then the extra cost would only be the 25,000 for the extra controls and not
no
The driving force behind additional elevators was determined by the World Trade Center 9/11 Commission. Additional elevators and greater separation was deemed to provide a greater factor of safety in the event of a terrorist attack of similar nature. The evacuation and fire fighter access time is greater in these buildings. The building height threshold for additional passenger and additional fire access would be appropriate for ultra high-rise buildings.
Use of building, Orientation of building for egress and exit
They would not require a 2nd set because the corridor on all floors would serve the 2 means of exit requirements. The fire service elevators are required to be auxiliary means of exiting
Maybe
The fire service access elevator is for the fire professional to gain access to the building to fight the fire, it should be near the fire entrance at the safest approach to the building, this is generally through the loading dock and the service elevator. The service elevator also generally has a protected lobby on all floors, an added safety feature for fire fighters.
No
probably yes
ONLY if there are 2 VERY DISTINCT entrances to a building. Most people will return to the entry from which they entered during a fire. If the building is long/convoluted/has 2 towers that are characteristically differentiated such that people perceived they entered from a specific point, then that would be valid consideration. I'm "on the fence" if there should be 2 because the interior corridors are long/convoluted but there is only 1 perceived entry point. Possibly the fire fighters would have more control or remote access while the majority of the people ran to the "entry" elevator.
Only in an extremely tall building requiring many shafts......i.e. A 90 story building would have crossover lobbies at mid level and multiple shafts some which accessed lower levels only and some the higher levels only...
Hospital or medical facilities. Perhaps prison or penitentiary facilities and perhaps high occupancy areas such as auditoriums and theaters.
overall size of project
Possibly depending on circumstance.
This law effects the cost of condominiums to a much greater degree than office buildings.
The footprint of the building - if it was spread out and had two clearly different vertical transportation cores.
An egress stairway and standpipe is required for the Fire Service access elevator.
Possibly large assembly spaces on the upper floors like restaurants.
Difficult to quantify without a particular building program in mind, but one example might be a courthouse. If there are separate security and passenger elevators, there could be separate lobbies for two different fire service access elevators. This might be one occasion where a second fire service access elevator might make sense, as there typically are security or "traffic flow" considerations to keep the occupants segregated.
Different banks of elevators service different floors in the building.
Yes
A residential building with private elevators, where each apartment on a floor is served by a different elevator. Typically these types of luxury residential high-rise buildings use elevators with front and back openings, such that one elevator serves two apartments with an elevator lobby on each side for each apartment.
Buildings where the core serves all units i.e. not private elevator designs.
where travel distances exceed maximum hose length if hose is attached at nearby stairwell to the elevator if travel distances exceed that which may be studied to impact the time it takes for a fireman to reach either a building occupant in distress or the distance to the fire's source.
Separate wings requiring different access.
Yes, what about high rises that have different elev banks serving different floor clusters?
Square building with one elevator in each corner allowing residence access to units, now two fire service access elevator lobbies are needed. Local Fire Inspectors are known to excersize their authority and interpret code and potentially require the separation of the fire service elevators serving a single area. Thus addressing what if scenarios.
yes
Possibly
Large building footprints
possibly, if the exit egress at the Lobby level required different exit paths to egress the lobby and bldg.
I'm sure there are many
I'm sure there probably are.
Health care facilities generall have multiple elevators and therefore seperated elevators. however in new construction it would be relatively easy ro provide.
probably
Building split by 2 towers with public spaces between towers
Would try to limit that. There are several scenarios that Federal buildings could require separate vestibules.
See above
Multiple height or tower buildings
As an Architect, we follow the Code but also the requirements of our Clients. Yes, there I can envision such a scenario, but we would avoid it and most Owners would want to avoid it as well. As noted above, the real net result of this requirement is that the fireman' elevator lobby will also become the passenger elevator lobby. A zero is entered below because, I don't foresee two fire access elevator lobbies on most projects. Very unlikely.

The biggest design challenge and cost is the new requirement that fire-service elevators have a lobby of 150 SF and have direct access to an exit-stair. The requirement for a second fire-service elevator adds addition complication and cost.

Statistic	Value
Total Responses	42

14. If the code already required two fire access elevators at the time a project begins, how often would a second lobby for a fire service access elevator be required for your typical projects (estimated % of projects requiring an additional fire service access lobby)? Enter numbers only - no $ or comma or % signs.

Text Response
15
100
0
5
0
0
0
100
0
0
6
20
40
18
5
0
0
30
100
15
0
0
100
25
50
40
40
50
0
100
100
25
0
20
5
100
0
50
20
10
0
25
10
0
50
20
0
0
10
0

0
45
5
0
2
100
0
0
0
0
50
1
35

Statistic	Value
Total Responses	63

15. What was the approximate additional construction cost ($) to make the elevator(s) fire service access compliant? Include all associated construction costs. Enter numbers only - no $ or comma or % signs.

Text Response
112000
300000
1000000
150000
60000
0
1
200000
59,000
12000
65000
40000
0
0000000
28000
15000
80,000
150000
0
250000
25000
150000
50000
650000
125000
190
40000
200000
265000
43,000
40000
4200
0
400000
30000
50000
100000
8000
0
0
320000
456000
0
700000
350000
100000
2000000
50000
675000

Statistic	Value

Total Responses	49

16. What was the approximate total building project cost ($)? Enter numbers only - no $ or comma or % signs.

Text Response
77,315,000
96000000
200000000
96000000
2000000
130000000
1
20000000
9000000
13500000
32985000
20
0
120000000
22478500
10000000
24,000,000
75000000
17500000
50000000
65000000
55000000
40000000
65000000
50000000
55000000
90000000
72000000
36000000
63,000,000
80,000,000
2500000
90000000
650000000
10000000
60000000
2000000
250000000
04
60000000
12000000
280000000
120000000
45000000
15000000
100000000
60000000
55000000

Statistic	Value
Total Responses	48

17. How many stories was the structure?

Text Response
14
30
60
10
4
30
20
12
18
14
19
8
15
25
8
10
30
25
45
18
6
15
15
42
15
24
46
25
20
19
25
24
20
3
24
19
8
26
17
50
42
16
15
20
30
12
40
36
23
20

Statistic	Value

Total Responses	50

18. How many fire service access elevators were installed?

Text Response
1
2
2
1
0
1
2
1
1
1
1
1
1
1
2
2
1
2
1
1
1
1
2
1
1
2
2
4
1
1
12
2
0
1
2
1
5
2
1
2
2
2
1
2
1
2
1
2
2

Statistic	Value
Total Responses	49

19. How many total elevators were installed?

Text Response
6
5
20
4
1
4
4
4
2
3
4
3
15
8
1
4
4
3
6
3
7
6
4
7
5
6
10
4
6
6
12
7
1
4
25
4
10
6
2
2
5
10
21
3
8
4
4
5

Statistic	Value
Total Responses	48

20. How many fire service access elevator (elevators) were in the original design for this structure?

Text Response
1
2
2
1
0
4
2
1
0
1
1
1
1
0
2
2
1
2
3
1
1
1
5
1
1
2
2
2
1
1
12
2
0
1
2
1
4
2
25
2
2
1
1
1
1
8
1
2
1

Statistic	Value

Total Responses	49

21. What type of corridors were provided?

#	Answer	Bar	Response	%
1	interior		45	90%
2	exterior		1	2%
3	both		4	8%
	Total		50	

Statistic	Value
Min Value	1
Max Value	3
Mean	1.18
Variance	0.31
Standard Deviation	0.56
Total Responses	50

22. What type of expected use was the building?

#	Answer	Bar	Response	%
1	Residential		19	38%
2	Retail/Office		7	14%
3	Mixed: Residential and Retail/Office		12	24%
4	Other		12	24%
	Total		50	

Other
Institutional
self storage
Retail Mixed use/Hotel
Government
hotel
Hotel
Medical
Hotel
Institutiona / business
Plus 6 stories of below grade parking
hotel

Statistic	Value
Min Value	1
Max Value	4
Mean	2.34
Variance	1.49
Standard Deviation	1.22
Total Responses	50

23. What was your role on this project?

#	Answer	Bar	Response	%
1	Architect		21	42%
2	Civil/Structural Engineer		0	0%
3	Cost Estimator		0	0%
4	Developer		3	6%
5	Elevator Manufacturer/Installer		2	4%
6	Fire Protection Engineer		4	8%
7	General Contractor		14	28%
8	Local Fire Emergency Professional		0	0%
9	Mechanical/Electrical Engineer		2	4%
10	Other:		6	12%

Other:
code consultant
accessibility
Consultant
Architect / Construction Administrator
Code consultant
Elevator Consultant

Statistic	Value
Min Value	1
Max Value	10
Total Responses	50

24. What is the status of this project?

#	Answer	Bar	Response	%
1	In design/finance phase		12	24%
2	Permitted but construction has not begun		5	10%
3	In construction		8	16%
4	Occupied		25	50%
	Total		50	

Statistic	Value
Min Value	1
Max Value	4
Mean	2.92
Variance	1.59
Standard Deviation	1.26
Total Responses	50

25. Based on your experience, what factors have a significant impact on the additional cost of making a second elevator a fire service access elevator assuming it was planned from the design stage (check all that apply)?

#	Answer	Bar	Response	%
1	the increased size of the elevator to accommodate a stretcher (stretcher size 24”x84”)		28	53%
2	adding two way communications connected to the fire command center		26	49%
3	incorporating additional electrical requirements		27	51%
4	incorporating the emergency generator requirements		38	72%
5	incorporating additional structural requirements for the hoist way		24	45%
6	Other:		14	26%

Other:
The extra stair to service the fire elevator access lobby
lost useable and rentable space
Additional space for fire fighter lobby
Fire proffing
Additional air conditioning requirements, loss of rentable space
I would not require full stretcher access but rather reclining chairs
Independence of multiple elevators is unclear and inpretative, if permitted within same shaft, lobby and load shedding, no significant impact. If independent lobbies, shafts, stairways AHJ required then costs and design impact are significant.
AdditioFire Service Elevatores due to multiple private elevator cores.
Biggest factor is locating fire sevice access lobby directly connected to egress stair. 2 elevators could have programmatic issues.
lost lease area
Elevator maintenance contracts, after hours service calls
All of the above
air plenum costs
Increased building are for the fire service elevator lobby. Position of the lobby in the building and potential to need to add a third exit stair.

Statistic	Value
Min Value	1
Max Value	6
Total Responses	53

26. Do you anticipate the Code’s 2nd fire service access elevator will be beneficial overall?

#	Answer	Bar	Response	%
1	Yes		78	45%
2	No		94	55%
	Total		172	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.55
Variance	0.25
Standard Deviation	0.50
Total Responses	172

27. Do you have any specific concerns about the requirement?

Text Response
Most multiple elevator bank systems allow the fire personnel to select which elevator to use so it does not seem like a redundancy issue. Another fire responder will be required to operate the additional elevator taking him away from other fire or life safety duties. Having only one machine will better ensure it is maintained well; once you add more items to maintain frequently the maintenance staff attention is divided. The emergency generator sizes will need to increase to ensure it can absorb operation of both elevators into the overall load. The occupants are supposed to be using the stairs to egress
I just question whether the standards being utilized for minimum dimensions and access are being updated to match with current technology and rescue training. It seems like it has not really changed in my 25 years of practice...
The extra stair
120' is too low. second elevator should not be required until building height exceeds 400'
Cost and impact on design
onerous
always adding to what is wanted with vast increase in cost and limited improvement or limited safety help. focus should be on 'reasonable' and safety and usefulness
The cost of the code change should be weighed with respect to the need of a second elevator. In aviation, which has a solid safety record, the ad's or modifications to aircraft are only required after a study of cost and effect on existing planes. Has there been such a study? I would guess that the effect would be great on large citys and in some cases impossible to comply with.
Most ten story and higher structures that we have worked are designed with more than one isolated elevator shaft providing a viable fire service access elevator in the event of an emergency. Although the price to provide a second fire service access elevator on some smaller buildings would be prohibitive, I feel that the over-all safety of the building occupants should be the over-riding criteria in the development of new codes.
As stated before I feel that additional elevators in ultra high-rise buildings is more appropriate. A single fire access elevator up to 28-30 stories is appropriate. The relative cost in taller buildings is lower while the risk is higher. At a minimum a threshold of 28-30 stories would be more reasonable.
Don't elevators shut down during a fire? Why do we need a second elevator? You guys are going to increase the price of construction so much, investors are going to go to Georgia.
No.Good idea.
better to provide better fire protected stairways
For buildings which just fall over the new intended threshold, there may be owners which will look closely at their budgets to see if the cost/benefit works from an income prospective.
preventing water from entering the enclosure and maintain the accessible slope to the elevator.
Obviously the cost concerns that would be placed on the owner.
cost to the owner with little grantee of its performance in a real fire situation
will lead to people trying to use the elevators for egress instead of the protected stair enclosures
None ...other than cost to owners....SAFETY FIRST
Stop the madness.. just leave it alone.
Adds cost to cover an incident that is not a part of the usual occurance.
higher cost for less than 150' buildings, probably for higher bldgs. may make sense
Cost.
Obviously 2 would be safer than 1, however even the second elevator requirement does not guarantee a decrease in loss of property or loss of life.
Cost and space.
It will create a plethora of 9 story buildings "urban sprawl" vs. higher rise to 30 stories (as in most other metro areas)
Dont need it
No, we just need to accommodate this change going forward
No, as long as the criteria for adding a second fire service elevator are clear and unambiguous.
My professional opinion is that for building 120 ft or taller will have several elevators and the cost to make a second assess for firemen is minimal......especially when you consider the potential loss of lives of Folrida citizens.......and why would Florida want to have a lesser code requirement that most other states that use the international code?
Life safety needs to be efficient for the Fire Rescue and egress
The assumption that first responders will use a full stretcher is incorrect. Most stretchers will not go around corners and so a reclining wheel chair, which requires a shorter elevator length is a better solution if a second elevator is mandated. The use of a reclining chair would cut the elevator cost by at least 25%.
additional cost
no
COST
Anything to make a building safer
no
Requirement is not well defined and needs to be revised to a performance oriented requirement.
Need to consider the amount of people using the building if a second elevator is needed. Example: a small observation deck over 120 feet tall, but does not have a capacity for more than a few people. A small mono-rail platform may be high but it does not usually see more than 10 riders at a time waiting for a ride. These are some examples of where a 2nd elevator would not be needed.
Cost for installing
Yes, added costs.
A "one size fits all" approach seems inappropriate. Perhaps the requirement should be applicable only after some minimum building footprint or configuration is exceeded. Consider an oceanfront hotel that has a single wing and a single loaded corridor with oceanfront guest rooms and a central elevator lobby. Does a second fire service access elevator provide a real benefit to the responding firefighters?

I am not clear as to what the requirement entails. I am only assuming that the cab will need to accommodate a gurney, so the size of the second elevator might be larger than otherwise specified.

Hi-Rise Condos are often built on small parcels with a small footprint and high aspect ratio. With zoning set backs there is very little room for additional services and amenities as it is. I think this only makes sense if each floor has more than 10,000 sf where you may have the room to fit it in, but it still adds more cost to a project and with all the government regulations we have now, do we really need to add more?

Adding additional cost for an event that might never happen in the life cycle of a building for another fire elevator is overkill for a building that low. With type I construction, fire sprinkler systems, egress stairs in fire rated shafts, exhaust systems, standpipe systems, the occupants should have enough time and protection to evacuate a building.

No. The economic cost from fire affecting tourism has been well documented after major fires in Las Vegas and Puerto Rico. Florida's economy is heavily dependent on tourism and protections shall be in place to not only protect the public but also protect our economy.

No.

I do not have any concerns about the requirement.

I say yes only because we want to keep the safety of the firefighters of most importance.

Cost of installation, testing, maintenance, ongoing testing

Cost, many times fires disable the electrical supply to elevators so stairs would be more reliable

no

we most definitely have a need to increase the ability to fight disasters and evacuate hi rise buildings with as many tools as possible. There have been too many instances where there were not enough available routes or avenues for escape. It is a safety concern for anyone that works in a high rise or stays in a high rise hotel anywhere in the US not just Florida

Not necessary

Extra cost does not seem highly beneficial

Designers resistance to the added cost has been raised, and I fear the argument may tout the added safety the additional elevator provides.

No

No

No

Should be based on units served.

Seems like over reaction to safety concerns. One fire service elevator is enough.

Cost

Square feet per story is very important. Some buildings will be all staircases and elevators.

NO

No other city requires this. I have done extensive code consulting work for the city of Chicago, and not one single high-rise requires this.

Concerned that the grandfather provisions to be under the current code I understand is tied to the elevator subcontractor permit - where as it should be to the first building permit so if you are in for foundations on a fast track job, you can rely on the current code applying even if there are schedule delays that cause your elevator permit to slip past the date of the code change

Only that it won't be passed.

For an isolated incident, the cost seems to be excessive. If the only requirements were a separate shaft and separate equipment, and power to run off emergency generator, that would be one thing, but a host of additional special requirements makes the additional costs excessive.

No

Adding a 2nd elevator which will also be dedicated to use for fire/rescue access will not have a significant benefit and result in unnecessary cost burdens to the client/developer. Buildings such as these typically have more than one passenger elevator and at least one delivery/cargo elevator in addition to the one elevator also dedicated to fire/rescue. It may be more practical to implement design requirements either for the cargo/delivery cab or at least one passenger elevator to be compliant with the needs of fire/rescue departments & personnel.

The true answer is, not sure, especially in a fully sprinkled building.

Cost to Owners

No

It appears to be overkill

Yes, this added requirement is not practical and will cost more.

Added burden on landlord to employ elevator maintenance for added service elevator. Elevator companies will make this another item for which they will increase their rates, create reasons why they are unable to meet construction schedules.

More cost added to the high rise buildings. Developers spend a lot of money in fancy finishes to impress clients, but in my experience since safety is not visible, they will not do anything additional on safety issues unlees it is written in black and white in the code.

The purpose of the second fire service elevator is vague, other than possible time savings response of a fire department crew.

Cost and access concerns. I'd favor the use of a 2nd FS elevator if the normal elevator system was utilized as a means of egress. The sprinkler and smoke control systems for these structures should be capable of maintaining a controlled condition for any fire conditions short of a WTC catastrophe. If terrorist concerns are driving this requirement, I think that creating dual (or more) elevator lobbies with minimal separations would be more advantageous for FD access.

No

There are legitimate concerns regarding the costs associated with adding this conveyance. At 120' of rise the costs for each elevator would be around $200K, and would impact development. Firefighters are instructed to not use elevators beyond access to five floors below any active fire floor.

The circumstance where even one fire service elevator is necessary are extermely rare. Such catastrophic events as would require 2 have rarely occurred. If a high rise structure were so fully involved it seems unlikely that a second fire service elevator would be of much help. HIgh rise structure fires are pretty rare and loss of life associated with them is even rarer.

no

to costly

The additional construction cost.

excessive
No
Space Planning, Over designed core.
no
The statistical probability there is an event warranting two fire access elevators is what? Given we can qualify (count) the building in the state to date that are over 120' and we can access the fire department's history per location. It should be a easy calculation. Given my personal experience in 30 yrs, I never seen it. Short of an airplane impact which is once every five years in the nation, what possible situation would require more than 12 fire fighters at once (arriving on the effective floors). Given the fact that fire fighters don't arrive in groups of 8 or more at once because of the fire station requirements.
cost to install and maintain
no
It has fundamentally changed how high-rise buildings are designed. There is obviously more cost, but it is a very difficult matter to quantify. Old Code we designed "oranges", New Code we design "apples". They are not the same. If the State of Florida makes a determination that only one fireman's elevator is required, do you still connect it to one fire stair? Do you still recognize the increase in the dead-end distance? Are the two fireman's elevators and connection to the fire exit stair fundamentally safer than a shorter dead-end, apparently the IBC has determined so. If Florida allows one fireman elevator, are they taking on the position that they disagree with the IBC?
A second fire-service elevator would be obviously beneficial if the first were inoperable due to a fire.However, the instances of its necessity are extremely rare in 10-20 story buildings. The requirement adds significant cost to to a relatively small building of Type I construction that has a very good life safety history. I think the requirement would be more in line with taller buildings (20+ stories) where risk may be greater. See comments below.
No
All projects will have problems, let us hope that those with experience are still around for the next few years.
no
Cost.

Statistic	Value
Total Responses	98

28. Additional Comments:

Text Response
argument for two is that you have higher capacity of ingress and egress; one unit is on its way up to a floor level while the other is on its way down.
Must be an independent systm.
Fire protection to structural members, and stairway structures
If the 2nd elevator is allowed to be in the same core of the building, then the increase in safety is likely very small. The 2nd elevator should be remote, which will radically increase the cost.
Renovation of existing buildings and any "grand-father" clause. MOST of the older buildings have a grand-father clause for bldg code requirements. However, the Fire Marshall tends to have the ability to override ALL code officials and can demand immediate improvements at their discretion. (not necessarily unfounded, but there is no safety net for older properties). Many older/existing properties do not have the spatial footprint for the standby generator. Also--during hurricanes, the standby generator needs to be elevated above grade so that it is not flooded and can keep working after power outages. Otherwise, this effort is all for naught.
Don't expect the additional cost to be significant in relation to the total job cost
If the Fire Dept. feels it is necessary, I defer to their expertise
Makes sense for larger high rise time-shares, hotels and hospitals.
Thank you for asking.
Is there an egress study completed that looks at the current code capacities for current buildings over 10 stories to prove the need for an additional elevator? I would think for buildings over 20+ stories where there are already multiple elevator banks that this should be considered and more cost effective. Otherwise the entire egress code should be revised.
May want to have number of units above a certain height be a requirement driver in addition to just the height. Basis should be on a required/desired rate of occupant removal.
Your interest in my opinion re this subject is most complementary however, I can't comment on this subject due to my lack of experience and interest. Objective comments wouldn't be forthcoming from my day to day experiences.
There is an obvious benefit to having redundancy in any life safety system. However, in absence of evidence suggesting that delaying the enforcement of the new requirement will result in unacceptable risks, I believe further study to determine whether the additional cost of requiring a 2nd fire service access elevator can be justified by the added safety may be warranted if incomplete, inaccurate, or inadequate information relating to the costs and benefits were presented when code revision was proposed.
Lighten up with the current codes.
I support the requirement for a second compliant elevator.
The majority of fire department and fire marshall personnel I have spoken to in my 15+ year career of designing high rise buidlings have said that under no circumstances would fire fighters use an elevator to fight a fire in a high rise. Other than for very tall highrises (50+ stories) I'm not sure what purpose having any fire service access elevators accomplishes. Also, one major issue with fire service access elevators is the requirement to connect a stair to the elevator lobby. Apparently it has been recognized that this stair requirement is a hardship on building design, as the 2015 IBC has provided an exception to this requirement in Section 3007.6.1 (see Section 3007.7.1 for this requirement - without the exception - in the current 2014 FBC). The FBC should consider adding this exception into Chapter 30. Finally, please consider providing an explaination of 2014 FBC Section 3007.4 Water Protection. This requirement is vague and confusing to everyone who I have spoken with, both on projects in Florida and elsewhere that use the IBC (which has the same vague requirement).
At this time regulation across the board is pinching the contractors building these buildings into accepting the additional costs just to get a job, and cutting the quality of the work to off set the additional requirements.
We need to reduce the code requirements in favor of more Sensible code requirements.
Please follow a building code model that is a coordinated code such as the IBC and do not take only some of the important pieces from the code and diminish the coordinated code concept.
Speaking in other matters I feel that the building code shall address mold and other health issues as well as safety.
Over and above adding significant dollars to cost of the construction of a Tower, the guidelines and requirements of the second elevator has made the design of residential towers less efficient, and leaving cumbersome amounts of inefficient space. I endorse appropriate safety regulations for those living in a residential tower.as saving lives is more important that saving construction costs. But I am not sure that some of these new "safety" building codes are initiated because of an unusual circumstance, rather than from reasonable practicality..
None
There has been an exterme concern about the safety of high rise buildings for many years. Back ot the Paul Newman disaster movie the Towering Inferno, but the facts indicate that current high rise structures equipped with fire sprinklers, emergency generators and modern fire detection system are among the safest structures we build. Far more people die each year from house and apartment fires. If we are truly promoting safety rather than worrying about potential future headlines we should concentrate our efforts where the risk is.
make all elevators havae fire service controls mandatory
Unless it can be documented that movement of firefighters faster can save more lives per year why make the tenants or business pay more for a least lightly event. There has to be some math some where that justify this cost in construction and long term maintenance.
I don't know all the answers to the above, but happy to assist, feel free to contact me. Michael G. Murphy, FL license #AR93292; tel 404-233-5353
I think the direct access to an exit stair should be required of only one elevator in buildings up to 20 stories; this car might also be a service car. I don't understand the basis of a minimum lobby size of 150 SF. I think the second fire-service elevator, as a back-up could be a passenger elevator without direct access to an exit stair. Buildings over 20 stories may have operational requirements that would necessitate a second service/fire-service elevator thereby minimizing any cost associated with meeting the proposed code requirement.
Maybe a requirement on buildings over 10 stories only.

Statistic	Value
Total Responses	28

Appendix K:
Access Elevator Survey Multiple Choice Questions Cross Tabulated by Profession

Fire Service Access Elevator Impact

Fire Service Access Elevator Impact

Cross Tabulation

342 Responses

Add Filters

		I am a (an):										
		Architect	Civil/Structural Engineer	Cost Estimator	Developer	Elevator Manufacturer/Installer	Fire Protection Engineer	General Contractor	Local Fire Emergency Professional	Mechanical/Electrical Engineer	Other	Total
Have you ever helped design, build or specify a fire service access elevator for a building?	Yes	65 69.9%	0 0.0%	3 42.9%	5 50.0%	3 42.9%	9 64.3%	32 39.0%	0 0.0%	10 45.5%	5 15.6%	124 48.8%
	No	28 30.1%	1 100.0%	4 57.1%	5 50.0%	4 57.1%	5 35.7%	50 61.0%	0 0.0%	12 54.5%	27 84.4%	130 51.2%
	Total	93 100.0%	1 100.0%	7 100.0%	10 100.0%	7 100.0%	14 100.0%	82 100.0%	0 100.0%	22 100.0%	32 100.0%	254 100.0%
Have any of your projects had more than one fire service access elevator?	Yes	18 30.0%	0 0.0%	0 0.0%	2 40.0%	2 66.7%	4 50.0%	6 20.0%	0 0.0%	3 33.3%	3 60.0%	36 31.3%
	No	42 70.0%	0 0.0%	3 100.0%	3 60.0%	1 33.3%	4 50.0%	24 80.0%	0 0.0%	6 66.7%	2 40.0%	79 68.7%
	Total	60 100.0%	0 100.0%	3 100.0%	5 100.0%	3 100.0%	8 100.0%	30 100.0%	0 100.0%	9 100.0%	5 100.0%	115 100.0%
Are there any other factorsthat would warrantan increase or decrease in your estimate?	Increase	20 100.0%	0 0.0%	0 0.0%	1 100.0%	1 100.0%	1 50.0%	9 100.0%	0 0.0%	1 100.0%	1 100.0%	34 97.1%
	Decrease	11 55.0%	0 0.0%	0 0.0%	1 100.0%	0 0.0%	1 50.0%	4 44.4%	0 0.0%	1 100.0%	0 0.0%	18 51.4%
	Total	20 100.0%	0 100.0%	0 100.0%	1 100.0%	1 100.0%	2 100.0%	9 100.0%	0 100.0%	1 100.0%	1 100.0%	35 100.0%
What type of corridors were provided?	interior	22 91.7%	0 0.0%	1 100.0%	1 50.0%	0 0.0%	4 100.0%	12 80.0%	0 0.0%	3 100.0%	3 100.0%	45 90.0%
	exterior	0 0.0%	0 0.0%	0 0.0%	1 50.0%	0 0.0%	0 0.0%	1 6.7%	0 0.0%	0 0.0%	0 0.0%	1 2.0%

		I am a (an):										
		Architect	Civil/Structural Engineer	Cost Estimator	Developer	Elevator Manufacturer/Installer	Fire Protection Engineer	General Contractor	Local Fire Emergency Professional	Mechanical/Electrical Engineer	Other	Total
	both	2 8.3%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	2 13.3%	0 0.0%	0 0.0%	0 0.0%	4 8.0%
	Total	24 100.0%	0 100.0%	1 100.0%	2 100.0%	0 100.0%	4 100.0%	15 100.0%	0 100.0%	3 100.0%	3 100.0%	50 100.0%
What type of expected use was the building?	Residential	10 41.7%	0 0.0%	0 0.0%	2 100.0%	0 0.0%	1 25.0%	5 33.3%	0 0.0%	1 33.3%	1 33.3%	19 38.0%
	Retail/Office	3 12.5%	0 0.0%	1 100.0%	0 0.0%	0 0.0%	2 50.0%	2 13.3%	0 0.0%	0 0.0%	0 0.0%	7 14.0%
	Mixed: Residential and Retail/Office	7 29.2%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	4 26.7%	0 0.0%	0 0.0%	1 33.3%	12 24.0%
	Other	4 16.7%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 25.0%	4 26.7%	0 0.0%	2 66.7%	1 33.3%	12 24.0%
	Total	24 100.0%	0 100.0%	1 100.0%	2 100.0%	0 100.0%	4 100.0%	15 100.0%	0 100.0%	3 100.0%	3 100.0%	50 100.0%
What was your role on this project?	Architect	21 87.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	21 42.0%
	Civil/Structural Engineer	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
	Cost Estimator	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
	Developer	1 4.2%	0 0.0%	0 0.0%	2 100.0%	0 0.0%	0 0.0%	1 6.7%	0 0.0%	0 0.0%	0 0.0%	3 6.0%
	Elevator Manufacturer/Installer	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 6.7%	0 0.0%	1 33.3%	0 0.0%	2 4.0%
	Fire Protection Engineer	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	4 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	4 8.0%
	General Contractor	0 0.0%	0 0.0%	1 100.0%	1 50.0%	0 0.0%	0 0.0%	14 93.3%	0 0.0%	0 0.0%	0 0.0%	14 28.0%
	Local Fire Emergency Professional	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
	Mechanical/Electrical Engineer	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	2 66.7%	0 0.0%	2 4.0%
	Other:	3 12.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	3 100.0%	6 12.0%
	Total	24 100.0%	0 100.0%	1 100.0%	2 100.0%	0 100.0%	4 100.0%	15 100.0%	0 100.0%	3 100.0%	3 100.0%	50 100.0%
What is the status of this project?	In design/finance phase	9 37.5%	0 0.0%	0 0.0%	1 50.0%	0 0.0%	0 0.0%	1 6.7%	0 0.0%	0 0.0%	1 33.3%	12 24.0%
	Permitted but construction has not begun	5 20.8%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	5 10.0%

		I am a (an):										
		Architect	Civil/Structural Engineer	Cost Estimator	Developer	Elevator Manufacturer/Installer	Fire Protection Engineer	General Contractor	Local Fire Emergency Professional	Mechanical/Electrical Engineer	Other	Total
	In construction	4 16.7%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 25.0%	1 6.7%	0 0.0%	2 66.7%	0 0.0%	8 16.0%
	Occupied	6 25.0%	0 0.0%	1 100.0%	1 50.0%	0 0.0%	3 75.0%	13 86.7%	0 0.0%	1 33.3%	2 66.7%	25 50.0%
	Total	24 100.0%	0 100.0%	1 100.0%	2 100.0%	0 100.0%	4 100.0%	15 100.0%	0 100.0%	3 100.0%	3 100.0%	50 100.0%
Based on your experience, what factors have a significant impact on the additional cost of making...	the increased size of the elevator to accommodate a stretcher (stretcher size 24"x84")	15 60.0%	0 0.0%	1 50.0%	1 50.0%	0 0.0%	1 25.0%	9 56.3%	0 0.0%	0 0.0%	1 33.3%	28 52.8%
	adding two way communications connected to the fire command center	11 44.0%	0 0.0%	2 100.0%	1 50.0%	0 0.0%	1 25.0%	9 56.3%	0 0.0%	1 33.3%	2 66.7%	26 49.1%
	incorporating additional electrical requirements	10 40.0%	0 0.0%	2 100.0%	1 50.0%	0 0.0%	2 50.0%	9 56.3%	0 0.0%	3 100.0%	1 33.3%	27 50.9%
	incorporating the emergency generator requirements	16 64.0%	0 0.0%	2 100.0%	2 100.0%	0 0.0%	3 75.0%	11 68.8%	0 0.0%	3 100.0%	3 100.0%	38 71.7%
	incorporating additional structural requirements for the hoist way	10 40.0%	0 0.0%	1 50.0%	0 0.0%	0 0.0%	1 25.0%	11 68.8%	0 0.0%	0 0.0%	1 33.3%	24 45.3%
	Other:	9 36.0%	0 0.0%	0 0.0%	1 50.0%	0 0.0%	1 25.0%	3 18.8%	0 0.0%	0 0.0%	0 0.0%	14 26.4%
	Total	25 100.0%	0 100.0%	2 100.0%	2 100.0%	0 100.0%	4 100.0%	16 100.0%	0 100.0%	3 100.0%	3 100.0%	53 100.0%
Do you anticipate the Code's 2nd fire service access elevator will be beneficial overall?	Yes	25 51.0%	1 100.0%	1 16.7%	1 14.3%	1 25.0%	3 33.3%	23 39.0%	0 0.0%	4 30.8%	19 65.5%	76 45.0%
	No	24 49.0%	0 0.0%	5 83.3%	6 85.7%	3 75.0%	6 66.7%	36 61.0%	0 0.0%	9 69.2%	10 34.5%	93 55.0%
	Total	49 100.0%	1 100.0%	6 100.0%	7 100.0%	4 100.0%	9 100.0%	59 100.0%	0 100.0%	13 100.0%	29 100.0%	169 100.0%

		I am a (an):
Have you ever helped design,	Chi Square	36.4*

build or specify a fire service access elevator for a building?	Degrees of Freedom	9
	p-value	0.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		I am a (an):
Have any of your projects had more than one fire service access elevator?	Chi Square	8.3*
	Degrees of Freedom	9
	p-value	0.5

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		I am a (an):
Are there any other factorsthat would warrantan increase or decrease in your estimate?	Chi Square	2.6*
	Degrees of Freedom	9
	p-value	1.0

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		I am a (an):
What type of corridors were provided?	Chi Square	27.6*
	Degrees of Freedom	18
	p-value	0.1

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		I am a (an):
What type of expected use was the building?	Chi Square	19.4*
	Degrees of Freedom	27
	p-value	0.9

Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.

		I am a (an):
What was your role on this project?	Chi Square	196.5*
	Degrees of Freedom	81
	p-value	0.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		I am a (an):
What is the status of this project?	Chi Square	27.1*
	Degrees of Freedom	27
	p-value	0.5

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		I am a (an):
Based on your experience, what factors have a significant impact on the additional cost of making...	Chi Square	18.0*
	Degrees of Freedom	45
	p-value	1.0

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

		I am a (an):
Do you anticipate the Code's 2nd fire service access elevator will be beneficial overall?	Chi Square	14.6*
	Degrees of Freedom	9
	p-value	0.1

**Note: The Chi-Square approximation may be inaccurate - expected frequency less than 5.*

TIP: On the Edit Survey page, select a question and Ctrl+click other questions to select multiple questions at once.

Appendix L:

Access Elevator Survey Comments

Note: Comments are sorted into categories created by the report authors.

Answer 7

If yes, [Have any of your projects had more than one fire service access elevator] ***why were they equipped with more than one fire service access elevator?***

ANTICIPATED THE FLORIDA CODE CHANGE

1. Due in anticipation to the new Florida Building Code

BUILDING SPECIFIC REASON

1. Elevators have regular service schedules taking them out of service, and is why most high rise projects have more than one elevator anyway. Allowing them to serve as fire service elevators as well is not a great effort or expense. It also qualifies for underwriter relief, financially.
2. It only makes common sense. All other building services have redundancy
3. Life safety trumps budget!
4. Redundancy

CODE REQUIREMENT

1. 2012 IBC requirement
2. ACHA State requirements
3. Adhere to IBC code requirements.
4. Because the 2012 IBC required it to be installed in accordance with the high rise provisions greater than 120 feet.
5. Code required it. For building 120' or more.
6. Code required two
7. Code requirement
8. Requirement of 2012 IBC
9. The international building code requires this in section 406.6.3....and all states that utilize this code have this requirement.
10. They followed the 2012 IBC
11. They were located in states that follow the 2012 International Building Code, which requires two fire service access elevators per Section 403.6.1 Fire service access elevator.
12. to meet code
13. Using the 2015 edition of IBC
14. yes, many were designed in accordance with 2012 IBC

DESIRED FEATURE

1. Elevators have regular service schedules taking them out of service, and is why most high rise projects have more than one elevator anyway. Allowing them to serve as fire service elevators as well is not a great effort or expense. It also qualifies for underwriter relief, financially.
2. It only makes common sense. All other building services have redundancy
3. Life safety trumps budget!
4. Redundancy

OTHER

1. Hyde Beach, Brickell City Center, Paraiso Bay
2. Plenty of them
3. Yes

Answer 9

Comments on the above cost: *[For this project then [[three bank elevator example]], what is your best estimate of the additional cost ($) for making a second elevator fire-service access compliant (assume it is being served by the same lobby as the other fire service access elevator)?]*

AREA REQUIRED

1. Area lost to access to fireman vestibule and fire stair on every floor of the building
2. Cost is based on additional square footage required for elevator and additional size of generator to run 2 elevators. The equipment cost would not change dramatically.
3. In addition if the fireman's lobby on each level has to increase in size to have two elevator doors open into it - then lost rentable sf results which likely is a bigger impact long term than the upfront capital cost increase
4. Larger elevator, enclosure with access to a fire stair, fire communication, additional fire riser. That's a lot for a 120' building.
5. The additional cost is due to having area of refuge for the 2nd elevator. In addition to the cost of the 2nd set of elevator doors the building would need to designate a minimum of 150 sf/floor for each floor. Using current construction costs we would estimate that the total project cost would be $500,00 at a minimum. It could be higher due to the configuration necessary to accomplish this code requirement.
6. The direct cost for the elevator operation is only part of the costs. Lobby access & other changes to comply will affect the cost depending on the level of solution.
7. The extra fir access elevator itself is not the issue, it's the required stair for the fire elevator access lobby.
8. The major impact of cost, if I understand the scenario, is mostly the extra square footage to access the stair.
9. There is also additional lost revenue due the larger cab size reducing the rentable floor area.
10. This issue is more complex than simply additional fire access elevators. The code also requires that the fire access elevator lobby have direct access to a fire stair, this is the bigger issue. Typically, the elevator lobbies want to be in the center of the floor to serve occupants equally and the exit stairs at the third points for egress. If you try to use the passenger elevators as fire-service elevators it requires that the lobby to be moved off center and attached to an exit stair. This may compromise the usability of the floor. Typical preferred passenger elevators are 3500# with center opening doors. To double as fire-service they need to be side opening (not preferred) or 4,000#(added cost) cars to accommodate a stretcher. A 12 story building would probably have a dedicated service elevator that could also function as a fire-service elevator located adjacent to one of the fire stairs. The proposed second fire service elevator and expanded fire service elevator lobby are added cost. $300,000 for an additional fire-service elevator and $125,000 for the addition gross building area for the increased fire-service elevator lobbies (12).

COST BREAKDOWN

1. 20000 per stop
2. A lot depends on the number of stops this cost is $145k for elevator + $45k.for lobby.
3. Assume additional 8,000 per stop to one of the already specified elevators.
4. Assumes floor plan changes required to maintain lobby to both fire service elevators, added generator capacity for two elevators, added A/E design fee due to increased complexity

5. It is determined by height of building cost is based on each stop. / 30 k per stop or floor, also the cost of building structure needs to be added
6. The additional costs reflect the upsizing of the structural shafts, the platforms, the electrical and air conditioning loads, the loading requirements for the elevators, the notifications and controls modifications for the operations, the reporting and notifications wiring, additional emergency power capacity and duration, additional fuel storage capacity, additional floor area requirements for generator, fuel tanks, elevators size increases.

GUESSING OR NOT SURE OF ESTIMATE

1. Guesstimate only
2. hard to break out exactly
3. It has been too long since I did this work to give a reasonable estimate of cost, but there is no doubt it will be a 2000 - $5000 minimum add. Since most of the work involves specialty contractors, call Otis, and Miami Elevator, they could best determine internal equipment cost and labor.

HOISTWAY, MACHINE ROOM AND EMERGENCY POWER

1. Assumes common machine room and all three elevators and their related equipment are able to run on the planned emergency power source. Need to add hoist way lighting and some additional elevator controller functionality to the second fire-service access elevator. / /
2. Assumes single speed hoistway doors with baked enamel finish.
3. Based on additional parts and labor for the conversion.
4. Cost also includes upsizing of generator to operate the added elevator.
5. Cost is for elevator control software and additional apparatus in machine room as well as additional key switches and related hardware.
6. Increases elevator controls cost, size and cost of emergency generator, communications equipment in the elevator
7. Individual power, controls
8. Larger generator, lights inside the shaft, additional fire alarm, additional elevator cost, shaft accommodations to
9. Mechanically, unless an additional elevator is provided no additional cost is anticipate.
10. Not involved with the cost but it is significant because generator size increases and if designed under the 2012 or 2015 IBC the provisions of the code required a significant amount of additional construction to comply with 3007.
11. The bulk of the cost is in control modifications, cabling and signaling devices.
12. The cost of adding additional emergency power, wiring, control, etc. is more but manageable, the real issue to us in the design of high-rise buildings is that these two fire-service elevators must enter into a fireman's elevator lobby that is required to be connected to one of the buildings fire stairs. Along with the requirement that mandated two fireman's elevator the IBC also relaxed or changed the dead-end corridor requirements.   / / The planning implications of this are huge. For example, Under the "old' Code, for a rectangular residential high-rise building, we would typically run a corridor down the middle, put a stair at each end of the corridor (to restrict the dead-end distance to 20 feet) and put the elevators in the middle. We might have one, but not two service elevators in a separate elevator vestibule. / / Under the "new" Code, the elevators, which were typically located in a more central location to the building "migrates" toward one of the ends so it can connect to one of the fire stairs. The dead-end corridor gets longer (Up to 50 feet is allowed) NFPA has allowed a longer dead end distance for some time.
13. The costs of the additional elevator requirements are detrimental to developers and building construction. In many cases projects will be scrapped due to the limitations of the site and the

lack of feasibility and constructability of typical buildings. Small sites which are now being developed will not be able to be constructed therefore making them undesirable to developers.
14. There are many variables but in a building of this size the cost is nominal.....you already have the systems for one required so it is just an operational issue with some electrical costs.
15. This is just for added electrical costs only.
16. This would require more sensors and communication systems which would increase the risk of system failure in the event of a major event. To limit the risk it would require 2 completely different system all the way to the fire control room. But there is no real way to have 2 "completely" separate systems. / Ask yourself why do we have fire inspection annually? to insure the system is operational, The system in the high rises experience sensor and communication failure far more than any other component. / Yet this code change only increase the likely hood of communication errors by doubling the sensors and communication systems into one monitoring system. Meaning in a major event the system would shut down both elevators and the operator in the fire control room couldn't keep up with the override protocol or procedure to keep them working in a major event, thus putting first responders at risk.
17. To upgrade 2nd elevator to fire rated
18. Typically see about a 21% cost increase in elevator and shaft way construction.
19. Uses common shaft and emergency gen load shedding for power requirements.

MINIMAL COST

1. All building elements are already in place for the 2nd fire service access elevator. There is minimal cost to install the second fire service elevator utilizing the same hoistway, lobbies, etc.
2. There is minimal cost associated with this, as the second fire service access elevator will typically occupy the same hoistway as the first, therefore the requirements of the hoistway (lighting, structural integrity of hoistway) are already included in the project cost. The only other requirement is that the second fire service access elevator be at least 3,500 lbs capacity, however this is a very common elevator size that is frequently used regardless of if the elevator is used for fire service or not.

NOT KNOWLEDGEABLE ABOUT COSTS

1. No high rise designs on table at this time
2. Not Sure. No relevant Experience
3. Require subcontractor bid

OTHER

1. Additional work etc
2. High
3. None
4. The additional cost does not compare to the lifesaving benefit for human life.
5. The cost above is meaningless as it will vary widely depending on building type. A relatively modest of 10-15 stories residential tower with a single bank of elevators, light loads may be able to adapt a normally passenger elevator at relatively small cost. A high rise office building with 30 or more stories with multiple elevator banks would generally have low rise and high-rise banks of elevators serving only some floors. A single freight elevator serving every floor is generally provided and also serves as the Fire Service elevator. In that situation adding a second fire service elevator would be very expensive requiring an additional set of machinery.

6. This is a variable and could go much higher or lower based on type style and required space that is needed and space that will be lost to revenue. / / This is however a very needed aspect. Safety should always come first without any regard for cost. How much is 1 life worth. I can't even believe there is a survey on this. Just do it! /
7. Due to the requirements to provide accessible means of egress, I believe the extra fire service access elevators need to be provided. While having people carry the disabled down the stairs, most people are loathe to leave their wheelchairs. Providing the extra protection via a Fire Service Access Elevator or an Occupant Evacuation Elevator with communication features for waiting residents seems like the new higher bar which needs to be included in buildings hither forth. / (akin to how stairs were "made" to be 44" wide and have 7" riser/11" tread requirements compared to the 24"-36" stairs with 8" r/9-10" treads! MAJOR change to the construction industry). /

Answer 10a – Increase Factors

Are there any other factors that would warrant an increase or decrease in your estimate [Example with 3 elevator bank]? INCREASE

ALARM AND SPRINKLER DESIGN

1. Alarm and Sprinkler design
2. Fire proofing and sprinklers or lack thereof in building. Proximity to first responders.

DIFFERENT BUILDING, ELEVATOR OR LOBBY CONFIGURATION

1. A modification to the building footprint which would add gross area to the project's scope
2. Actual configuration of the elevator lobby in relation to the stairs. Extra elevator cab doors.
3. Depending on the footprint of the building, if the elevators were required to be in different shafts, not serving the same lobby.
4. Height of building, area to be added to building volume, structure is also an added cost
5. High rise office building with multiple banks of elevators serving different ranges of floors
6. If location of fire service elevator does not allow 'direct access to a fire stair', additional cost may be realized if it is needing to be relocated.
7. If the 2nd fire access elevator had to be in a separate core that would have a significant cost increase
8. If the non-fire service access elevators were 2,500 lbs capacity there would be a cost to change the elevator in question to 3,500 lbs and increase the hoistway size.
9. On a 50 story building the problem is exponential
10. Size of elevator
11. Small units\ cores thus multiple cores adds additional second cores.
12. The higher to goes the more reinforcement it needs
13. Type of shaft way construction as base to estimate: increase shaft wall, for example.
14. Upgrade hoistway door finish / Change to two speed or biparting
15. Use

GENERATOR AND CONTROLS

1. Generator requirements
2. If the planned emergency power source is only capable of running one (1) elevator at a time, would need to increase the size of the generator.
3. In structural, electrical, mechanical, elevator, controls and long term monitoring costs.
4. No infrastructure present, electrical etc.
5. Separate shaft, independent generator loading

LABOR AND MATERIAL COSTS

1. Labor. Materials
2. Local labor market, material cost
3. These contractors are hard to get to the jobsite and that usually delays the project and therefore increases OHD.

OTHER

1. 0
2. 100000
3. Building conditions
4. Increased inefficiency in the floor plate will put this building at a market disadvantage to a similar building <120'.
5. No
6. There is also a very confusing requirement about preventing water into the fireman's vestibule that adds cost. / / Only one of the elevators is required to   be stretcher capable.
7. Too many inspection and building restrictions
8. Its the extra stair that serves the required fire access elevator lobby that really adds cost, approximately 10,000 per floor

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Answer 10b – Decrease Factors

Are there any other factors that would warrant an increase or decrease in your estimate [Example with 3 elevator bank]? DECREASE

1. A single bank of elevators serving all floors.
2. Actual configuration of the elevator lobby in relation to the stairs.
3. Base spec of elevator might provide more functions required, and thus reduce cost of increase.
4. Height
5. If the 2nd elevator did not have to be enlarged - so stays a standard passenger cab size
6. in available leasable floor area
7. Local labor market, material cost
8. n/a
9. No
10. Not much to decrease based on the assumptions made.
11. Only Adds
12. Present infrastructure and it’s only a function of software.
13. See above.
14. Size of elevator
15. Slight decrease due to blanket prohibition of any sprinkler protection in machine room or hoistway serving fire service elevator

Answer 12

Comments on the above cost - please list those factors that would provide much of the cost you estimated in the previous question. *[What if there was another 12-story project being planned with one passenger elevator (a fire service access elevator) and one service/maintenance elevator serving a different lobby. What would be your estimate of the additional costs to convert the service elevator lobby into a fire service access elevator lobby?]*

AREA AND EQUIPMENT

1. Floor plan reconfiguration to have stairwell immediately accessible from each elevator lobby, increased generator capacity, additional A/E design fee
2. Lower cost than first option - however this will cut into leasable SF. Also if the fire lobby has to tie to a exit stair then this cost could go up substantially as the service elevator may not be located where the fire stair needs to go - and that could lead to the need to add another exit stair - more cost - more lost lease space
3. Size of lobby , egress length, emergency lighting, sprinkler, alarm design
4. The code requires that fire-service elevator lobbies have direct access to an exit stair and a minimum lobby size of 150 SF . To minimize cost the service elevator/fire-service elevator would attach to one fire exit stair and the passenger/fire-service would attach to the other. This is not optimal planning for users. Separating the two fire-service elevators doubles the fire-service lobby SF requirement($225,000). The typical 3500# passenger cars would need to be side opening (not preferred) or all increased to 4000#(added cost). The off center location of the passenger elevator lobby may be detrimental to marketing the building. / / If
5. The service lobby must become larger to be a fire service elevator and it must be connected to a stair.
6. Area lost to access to fireman vestibule and fire stair on every floor of the building

EQUIPMENT

1. Adequate communications for notification of presence of people.
2. Assuming lobby is sized adequately as planned, the additional cost is associated with equipment and controls
3. Contractor availability, Signage, Elevator control panel changes.
4. Controls and power are already separate. Just have to bring emergency power supply.
5. Costs center around elevator controller modification, elevator standby power selection, added switches and cabling for fire control. Upsizing of emergency generator to provide constant power.
6. Distance from primary elevator and equipment room
7. Equipment rooms in different areas
8. I estimate the wiring and controls as constituting the cost increase / The cost estimate does not include the cost of adding another stair which is probably 10,000 per floor
9. It would be minimal just changing the controls system
10. Location, power, structure and constructability
11. May need to replace generator if both elevators need to work at the same time as fire service elevator
12. Mostly software related costs

13. New lobby fire station, in-car fire controls. Cost of additional retro fitting of the control board.
14. The cost is only for the cost to upgrade the generator to carry the additional load and the associated transfer switches and wiring.
15. The most costly thing to do in a high rise is run more conduit and wire
16. This is just for added electrical costs only.
17. Typically, service and freight elevators require slightly greater upgrades to meet requirements.

FIRE PREVENTION OF LOBBY AREA

1. Added fire resistive rating, emergency power and water protection. Added door to stair from the lobby
2. Assume $4,000 per lobby to provide wall ratings, dampers, com equipment, etc.
3. Assumes upgrade to fire rated enclosure and lobby doors.
4. Converting to fire rated lobby enclosure walls and doors. Provided fire rated protection of wiring and cables for the second elevator that are not in the wire bundle for the first elevator. Lobby size may be larger than planned if not a fire-service access elevator, which may drive a higher cost impact than estimated above.
5. Fire-rated wall and door construction to separate the proposed elevator lobby from the adjacent space(s).
6. Many factors are involved including the fire rating of all interior finishes currently within the building, coverage of sprinkler heads, length of pathway, exterior access for first responders
7. New stairway required for fire service elevator or rated connection to common stairway.
8. This cost is to prepare the lobby area, doors, etc.

NO OR MINIMAL COST

1. Again no additional cost is anticipated.
2. Not significant

NOT REALISTIC EXAMPLE

1. A completely separate shaft would require many other costs......however it is not realistic to think that a 12 story building could function with only one passenger elevator.......thus this question should not be considered.
2. These estimates are generally meaning less. The above scenario offers the easiest adaptation.
3. This is a rough guess for the cost of a 3,500 lbs capacity elevator with 12 stops. Note however that it would be very unusual to only have 1 passenger elevator in a 12 story building.
4. This requires an architectural solution. / / First, what will most likely happen in the above scenario is that the service/maintenance elevator lobby will be deleted. There will only be ONE Lobby for firemen and public which is allowed, but not as desirable. This elevator lobby will connect to one of the fire stairs. / / The cost estimate above is to redesign the one passenger elevator with a front and rear door with the back door opening up to the fire service elevator lobby and the front door opening up to the passenger lobby. This is expensive.

SIMILAR COST TO FIRST EXAMPLE

1. All costs listed in example one would still be incurred except perhaps the structural component as the service elevator should be large enough to act as a fire service elevator.
2. Same as before.
3. See above

4. The additional costs would be the same because we only took into account the 150 sf requirement, which is necessary for each elevator.
5. The same approximate costs are involved as the first case

OTHER

1. Air plenum
2. I have assumed about 8,500/fl to select some level of solution.
3. Not Sure. No relevant Experience.
4. One new complete elevator and shaft.
5. Requires a subcontractor bid
6. 😃

Answer 13

Are there any other design situations where the two fire service access elevators would be separated and would therefore require a second fire service access elevator lobby? [other than the lobby example]

BUILDING GEOMETRY MAY DICTATE

1. Building split by 2 towers with public spaces between towers
2. Buildings where the core serves all units i.e. not private elevator designs.
3. Different banks of elevators service different floors in the building.
4. Large building footprints
5. Multiple height or tower buildings
6. Only in an extremely tall building requiring many shafts......i.e. A 90 story building would have crossover lobbies at mid-level and multiple shafts some which accessed lower levels only and some the higher levels only...
7. Overall size of project
8. Possibly large assembly spaces on the upper floors like restaurants.
9. Separate wings requiring different access.
10. Square building with one elevator in each corner allowing residence access to units, now two fire service access elevator lobbies are needed. / / Local Fire Inspectors are known to exercise their authority and interpret code and potentially require the separation of the fire service elevators serving a single area. Thus addressing what if scenarios.
11. The footprint of the building - if it was spread out and had two clearly different vertical transportation cores.
12. Where travel distances exceed maximum hose length if hose is attached at nearby stairwell to the elevator if travel distances exceed that which may be studied to impact the time it takes for a fireman to reach either a building occupant in distress or the distance to the fire's source.

CLIENT SPECIFIC

1. As an Architect, we follow the Code but also the requirements of our Clients. Yes, there I can envision such a scenario, but we would avoid it and most Owners would want to avoid it as well. / / As noted above, the real net result of this requirement is that the fireman' elevator lobby will also become the passenger elevator lobby. A zero is entered below because, I don't foresee two fire access elevator lobbies on most projects. Very unlikely.
2. Difficult to quantify without a particular building program in mind, but one example might be a courthouse. If there are separate security and passenger elevators, there could be separate lobbies for two different fire service access elevators. This might be one occasion where a second fire service access elevator might make sense, as there typically are security or "traffic flow" considerations to keep the occupants segregated.
3. Health care facilities generall have multiple elevators and therefore seperated elevators. however in new construction it would be relatively easy ro provide.
4. Hospital or medical facilities. Perhaps prison or penitentiary facilities and perhaps high occupancy areas such as auditoriums and theaters.
5. Use of building, Orientation of building for egress and exit
6. Would try to limit that. There are several scenarios that Federal buildings could require separate vestibules.

DISTINCT ENTRANCES

1. ONLY if there are 2 VERY DISTINCT entrances to a building. / Most people will return to the entry from which they entered during a fire. If the building is long/convoluted/has 2 towers that are characteristically differentiated such that people perceived they entered from a specific point, then that would be valid consideration. / / I'm "on the fence" if there should be 2 because the interior corridors are long/convoluted but there is only 1 perceived entry point. Possibly the fire fighters would have more control or remote access while the majority of the people ran to the "entry" elevator.
2. Possibly, if the exit egress at the Lobby level required different exit paths to egress the lobby and bldg.

NO

1. no
2. No
3. Not really, no.

POSSIBLY, PROBABLY, YES

1. If you didn't want to add a third stair in the middle of the building to service two fire access elevators then you could place the 2 required elevators at each end of the building adjacent to the stirs and then the extra cost would only be the 25,000 for the extra controls and not
2. I'm sure there are many
3. I'm sure there probably are.
4. Maybe
5. Possibly
6. Possibly depending on circumstance.
7. Probably
8. Probably yes
9. Yes
10. Yes
11. Yes, what about high rises that have different elevator banks serving different floor clusters?

OTHER

1. An egress stairway and standpipe is required for the Fire Service access elevator.
2. See above
3. The biggest design challenge and cost is the new requirement that fire-service elevators have a lobby of 150 SF and have direct access to an exit-stair. The requirement for a second fire-service elevator adds addition complication and cost.
4. The driving force behind additional elevators was determined by the World Trade Center 9/11 Commission. Additional elevators and greater separation was deemed to provide a greater factor of safety in the event of a terrorist attack of similar nature. The evacuation and fire fighter access time is greater in these buildings. / The building height threshold for additional passenger and additional fire access would be appropriate for ultra-high-rise buildings.
5. The fire service access elevator is for the fire professional to gain access to the building to fight the fire, it should be near the fire entrance at the safest approach to the building, this is generally through the loading dock and the service elevator. The service elevator also generally has a protected lobby on all floors, an added safety feature for fire fighters.

6. They would not require a 2nd set because the corridor on all floors would serve the 2 means of exit requirements. The fire service elevators are required to be auxiliary means of exiting
7. This law effects the cost of condominiums to a much greater degree than office buildings.

Answer 22

What type of expected use was the building? [Those selecting Other]

GOVERNMENT

1. Government

HOTEL

1. Hotel
2. Hotel
3. Hotel
4. Hotel

INSTITUTIONAL

1. Institutional / business
2. Institutional

MEDICAL

1. Medical

PARKING

1. Plus 6 stories of below grade parking

RETAIL MIXED USE/HOTEL

1. Retail Mixed use/Hotel

SELF STORAGE

1. Self storage

Answer 23

What was your role on this project? [Those answering Other for their role in the most recent project]

1. Accessibility
2. Architect / Construction Administrator
3. Code consultant
4. Code consultant
5. Consultant
6. Elevator Consultant

Answer 27

Do you have any specific comments about this requirement?

[Follows question "Do you anticipate the Code's 2nd fire service access elevator will be beneficial overall?"]

IT IS NEEDED

1. No. Good idea.
2. None ...other than cost to owners....SAFETY FIRST
3. No, we just need to accommodate this change going forward
4. No, as long as the criteria for adding a second fire service elevator are clear and unambiguous.
5. No. The economic cost from fire affecting tourism has been well documented after major fires in Las Vegas and Puerto Rico. Florida's economy is heavily dependent on tourism and protections shall be in place to not only protect the public but also protect our economy.

NOT NEEDED

1. Stop the madness, just leave it alone.
2. Don't need it
3. Not necessary
4. It appears to be overkill
5. Seems like over reaction to safety concerns. One fire service elevator is enough.
6. The circumstance where even one fire service elevator is necessary are extremely rare. Such catastrophic events as would require 2 have rarely occurred. If a high rise structure were so fully involved it seems unlikely that a second fire service elevator would be of much help. High rise structure fires are pretty rare and loss of life associated with them is even rarer.
7. The statistical probability there is an event warranting two fire access elevators is what? Given we can qualify (count) the building in the state to date that are over 120' and we can access the fire department's history per location. It should be a easy calculation. Given my personal experience in 30 yrs, I never seen it. Short of an airplane impact which is once every five years in the nation, what possible situation would require more than 12 fire fighters at once (arriving on the effective floors). Given the fact that fire fighters don't arrive in groups of 8 or more at once because of the fire station requirements.
8. excessive
9. Adding additional cost for an event that might never happen in the life cycle of a building for another fire elevator is overkill for a building that low. With type I construction, fire sprinkler systems, egress stairs in fire rated shafts, exhaust systems, standpipe systems, the occupants should have enough time and protection to evacuate a building.

SHOULD BE ONLY FOR TALLER OR BIGGER BUILDINGS

1. 120' is too low. second elevator should not be required until building height exceeds 400'
2. As stated before I feel that additional elevators in ultra-high-rise buildings is more appropriate. A single fire access elevator up to 28-30 stories is appropriate. The relative cost in taller buildings is lower while the risk is higher. At a minimum a threshold of 28-30 stories would be more reasonable.
3. higher cost for less than 150' buildings, probably for higher bldgs. may make sense

4. A second fire-service elevator would be obviously beneficial if the first were inoperable due to a fire. However, the instances of its necessity are extremely rare in 10-20 story buildings. The requirement adds significant cost to a relatively small building of Type I construction that has a very good life safety history. I think the requirement would be more in line with taller buildings (20+ stories) where risk may be greater. See comments below.
5. Need to consider the amount of people using the building if a second elevator is needed. Example: a small observation deck over 120 feet tall, but does not have a capacity for more than a few people. A small mono-rail platform may be high but it does not usually see more than 10 riders at a time waiting for a ride. These are some examples of where a 2nd elevator would not be needed.
6. A "one size fits all" approach seems inappropriate. Perhaps the requirement should be applicable only after some minimum building footprint or configuration is exceeded.
7. Consider an oceanfront hotel that has a single wing and a single loaded corridor with oceanfront guest rooms and a central elevator lobby. Does a second fire service access elevator provide a real benefit to the responding firefighters?
8. Hi-Rise Condos are often built on small parcels with a small footprint and high aspect ratio. With zoning setbacks there is very little room for additional services and amenities as it is. I think this only makes sense if each floor has more than 10,000 sf where you may have the room to fit it in, but it still adds more cost to a project and with all the government regulations we have now, do we really need to add more?
9. Should be based on units served.
10. Square feet per story is very important. Some buildings will be all staircases and elevators.

ONE IS BETTER THAN TWO

1. To operate the additional elevator taking him away from other fire or life safety duties. Having only one machine will better ensure it is maintained well; once you add more items to maintain frequently the maintenance staff attention is divided. The emergency generator sizes will need to increase to ensure it can absorb operation of both elevators into the overall load. The occupants are supposed to be using the stairs to egress.

TWO ARE BETTER THAN ONE

1. Most ten story and higher structures that we have worked are designed with more than one isolated elevator shaft providing a viable fire service access elevator in the event of an emergency. Although the price to provide a second fire service access elevator on some smaller buildings would be prohibitive, I feel that the over-all safety of the building occupants should be the over-riding criteria in the development of new codes.
2. Obviously 2 would be safer than 1, however even the second elevator requirement does not guarantee a decrease in loss of property or loss of life.
3. My professional opinion is that for building 120 ft or taller will have several elevators and the cost to make a second assess for firemen is minimal......especially when you consider the potential loss of lives of Florida citizens.......and why would Florida want to have a lesser code requirement that most other states that use the international code?
4. I do not have any concerns about the requirement.
5. I say yes only because we want to keep the safety of the firefighters of most importance.

MAY COST TOO MUCH

1. Cost and impact on design
2. Always adding to what is wanted with vast increase in cost and limited improvement or limited safety help. focus should be on 'reasonable' and safety and usefulness
3. The cost of the code change should be weighed with respect to the need of a second elevator. In aviation, which has a solid safety record, the ad's or modifications to aircraft are only required after a study of cost and effect on existing planes. Has there been such a study? I would guess that the effect would be great on large cities and in some cases impossible to comply with.
4. Don't elevators shut down during a fire? Why do we need a second elevator? You guys are going to increase the price of construction so much, investors are going to go to Georgia.
5. Obviously the cost concerns that would be placed on the owner.
6. Cost to the owner with little grantee of its performance in a real fire situation
7. Adds cost to cover an incident that is not a part of the usual occurrence.
8. Cost.
9. Cost and space.
10. COST
11. Cost for installing
12. Yes, added costs.
13. Cost of installation, testing, maintenance, ongoing testing
14. Cost, many times fires disable the electrical supply to elevators so stairs would be more reliable
15. Extra cost does not seem highly beneficial
16. Cost
17. For an isolated incident, the cost seems to be excessive. If the only requirements were a separate shaft and separate equipment, and power to run off emergency generator, that would be one thing, but a host of additional special requirements makes the additional costs excessive.
18. Cost to Owners
19. Yes, this added requirement is not practical and will cost more.
20. Added burden on landlord to employ elevator maintenance for added service elevator. Elevator companies will make this another item for which they will increase their rates, create reasons why they are unable to meet construction schedules.
21. There are legitimate concerns regarding the costs associated with adding this conveyance. At 120' of rise the costs for each elevator would be around $200K, and would impact development. Firefighters are instructed to not use elevators beyond access to five floors below any active fire floor.
22. Too costly
23. The additional construction cost.
24. Cost to install and maintain
25. Cost.
26. Adding a 2nd elevator which will also be dedicated to use for fire/rescue access will not have a significant benefit and result in unnecessary cost burdens to the client/developer. Buildings such as these typically have more than one passenger elevator and at least one delivery/cargo elevator in addition to the one elevator also dedicated to fire/rescue. It may be more practical to implement design requirements either for the cargo/delivery cab or at least one passenger elevator to be compliant with the needs of fire/rescue departments & personnel.

OTHER

1. Most multiple elevator bank systems allow the fire personnel to select which elevator to use so it does not seem like a redundancy issue. Another fire responder will be required

2. I just question whether the standards being utilized for minimum dimensions and access are being updated to match with current technology and rescue training. It seems like it has not really changed in my 25 years of practice...
3. The extra stair
4. Onerous
5. Better to provide better fire protected stairways
6. For buildings which just fall over the new intended threshold, there may be owners which will look closely at their budgets to see if the cost/benefit works from an income prospective.
7. Preventing water from entering the enclosure and maintain the accessible slope to the elevator.
8. Will lead to people trying to use the elevators for egress instead of the protected stair enclosures
9. It will create a plethora of 9 story buildings "urban sprawl" vs. higher rise to 30 stories (as in most other metro areas)
10. Life safety needs to be efficient for the Fire Rescue and egress
11. The assumption that first responders will use a full stretcher is incorrect. Most stretchers will not go around corners and so a reclining wheel chair, which requires a shorter elevator length is a better solution if a second elevator is mandated. The use of a reclining chair would cut the elevator cost by at least 25% additional cost
12. Anything to make a building safer
13. Requirement is not well defined and needs to be revised to a performance oriented requirement.
14. I am not clear as to what the requirement entails. I am only assuming that the cab will need to accommodate a gurney, so the size of the second elevator might be larger than otherwise specified.
15. We most definitely have a need to increase the ability to fight disasters and evacuate hi rise buildings with as many tools as possible. There have been too many instances where there were not enough available routes or avenues for escape. It is a safety concern for anyone that works in a high rise or stays in a high rise hotel anywhere in the US not just Florida
16. Designers resistance to the added cost has been raised, and I fear the argument may tout the added safety the additional elevator provides.
17. No other city requires this. I have done extensive code consulting work for the city of Chicago, and not one single high-rise requires this.
18. Concerned that the grandfather provisions to be under the current code I understand is tied to the elevator subcontractor permit - where as it should be to the first building permit so if you are in for foundations on a fast track job, you can rely on the current code applying even if there are schedule delays that cause your elevator permit to slip past the date of the code change
19. Only that it won't be passed.
20. The true answer is, not sure, especially in a fully sprinkled building.
21. More cost added to the high rise buildings. Developers spend a lot of money in fancy finishes to impress clients, but in my experience since safety is not visible, they will not do anything additional on safety issues unless it is written in black and white in the code.
22. The purpose of the second fire service elevator is vague, other than possible time savings response of a fire department crew.
23. Cost and access concerns. I'd favor the use of a 2nd FS elevator if the normal elevator system was utilized as a means of egress. The sprinkler and smoke control systems for these structures should be capable of maintaining a controlled condition for any fire conditions short of a WTC catastrophe. If terrorist concerns are driving this requirement, I think that creating dual (or more) elevator lobbies with minimal separations would be more advantageous for FD access.
24. Space Planning, Over designed core.
25. It has fundamentally changed how high-rise buildings are designed. There is obviously more cost, but it is a very difficult matter to quantify. Old Code we designed "oranges", New Code we design "apples". They are not the same. If the State of Florida makes a determination that only one fireman's elevator is required, do you still connect it to one fire stair? Do you still recognize

the increase in the dead-end distance? Are the two fireman's elevators and connection to the fire exit stair fundamentally safer than a shorter deadend, apparently the IBC has determined so. If Florida allows one fireman elevator, are they taking on the position that they disagree with the IBC?

26. All projects will have problems, let us hope that those with experience are still around for the next few years.

NO COMMENTS

1. No
2. No
3. No.
4. No
5. No
6. No
7. No
8. No
9. No
10. No
11. No
12. No
13. No
14. No
15. No
16. No
17. No
18. No

Answer 28
Additional Comments

HAPPY TO HELP

1. I don't know all the answers to the above, but happy to assist, feel free to contact me.
2. Thank you for asking.
3. Your interest in my opinion re this subject is most complementary however, I can't comment on this subject due to my lack of experience and interest. Objective comments wouldn't be forthcoming from my day to day experiences.

NOT BENEFICIAL

1. If the 2nd elevator is allowed to be in the same core of the building, then the increase in safety is likely very small. The 2nd elevator should be remote, which will radically increase the cost.
2. The majority of fire department and fire Marshall personnel I have spoken to in my 15+ year career of designing high rise buildings have said that under no circumstances would fire fighters use an elevator to fight a fire in a high rise. Other than for very tall high rises (50+ stories) I'm not sure what purpose having any fire service access elevators accomplishes. / / Also, one major issue with fire service access elevators is the requirement to connect a stair to the elevator lobby. Apparently it has been recognized that this stair requirement is a hardship on building design, as the 2015 IBC has provided an exception to this requirement in Section 3007.6.1 (see Section 3007.7.1 for this requirement - without the exception - in the current 2014 FBC). The FBC should consider adding this exception into Chapter 30. / / Finally, please consider providing an explanation of 2014 FBC Section 3007.4 Water Protection. This requirement is vague and confusing to everyone who I have spoken with, both on projects in Florida and elsewhere that use the IBC (which has the same vague requirement). / /
3. There has been an extreme concern about the safety of high rise buildings for many years. Back to the Paul Newman disaster movie the Towering Inferno, but the facts indicate that current high rise structures equipped with fire sprinklers, emergency generators and modern fire detection system are among the safest structures we build. Far more people die each year from house and apartment fires. If we are truly promoting safety rather than worrying about potential future headlines we should concentrate our efforts where the risk is.
4. We need to reduce the code requirements in favor of more Sensible code requirements.

REGULATIONS HURT COST

1. At this time regulation across the board is pinching the contractors building these buildings into accepting the additional costs just to get a job, and cutting the quality of the work to offset the additional requirements.
2. Lighten up with the current codes.
3. Over and above adding significant dollars to cost of the construction of a Tower, the guidelines and requirements of the second elevator has made the design of residential towers less efficient, and leaving cumbersome amounts of inefficient space. / I endorse appropriate safety regulations for those living in a residential tower.as saving lives is more important that saving construction

costs. But I am not sure that some of these new "safety" building codes are initiated because of an unusual circumstance, rather than from reasonable practicality.

4. There is an obvious benefit to having redundancy in any life safety system. However, in absence of evidence suggesting that delaying the enforcement of the new requirement will result in unacceptable risks, I believe further study to determine whether the additional cost of requiring a 2nd fire service access elevator can be justified by the added safety may be warranted if incomplete, inaccurate, or inadequate information relating to the costs and benefits were presented when code revision was proposed.
5. Unless it can be documented that movement of firefighters faster can save more lives per year why make the tenants or business pay more for a least lightly event. There has to be some math somewhere that justify this cost in construction and long term maintenance.

SHOULD BE MORE LIMITED

1. I think the direct access to an exit stair should be required of only one elevator in buildings up to 20 stories; this car might also be a service car. I don't understand the basis of a minimum lobby size of 150 SF. I think the second fire-service elevator, as a back-up could be a passenger elevator without direct access to an exit stair. Buildings over 20 stories may have operational requirements that would necessitate a second service/fire-service elevator thereby minimizing any cost associated with meeting the proposed code requirement.
2. Is there an egress study completed that looks at the current code capacities for current buildings over 10 stories to prove the need for an additional elevator? I would think for buildings over 20+ stories where there are already multiple elevator banks that this should be considered and more cost effective. Otherwise the entire egress code should be revised.
3. Makes sense for larger high rise time-shares, hotels and hospitals.
4. May want to have number of units above a certain height be a requirement driver in addition to just the height. Basis should be on a required/desired rate of occupant removal.

SUPPORT CODE CHANGE

1. I support the requirement for a second compliant elevator.
2. If the Fire Dept. feels it is necessary, I defer to their expertise
3. Please follow a building code model that is a coordinated code such as the IBC and do not take only some of the important pieces from the code and diminish the coordinated code concept.

OTHER

1. Speaking in other matters I feel that the building code shall address mold and other health issues as well as safety.
2. Renovation of existing buildings and any "grand-father" clause. MOST of the older buildings have a grand-father clause for bldg code requirements. However, the Fire Marshall tends to have the ability to override ALL code officials and can demand immediate improvements at their discretion. (not necessarily unfounded, but there is no safety net for older properties). Many older/existing properties do not have the spatial footprint for the standby generator. / Also--during hurricanes, the standby generator needs to be elevated above grade so that it is not flooded and can keep working after power outages. Otherwise, this effort is all for naught.

3. Argument for two is that you have higher capacity of ingress and egress; one unit is on its way up to a floor level while the other is on its way down.
4. Don't expect the additional cost to be significant in relation to the total job cost
5. Fire protection to structural members, and stairway structures
6. Make all elevators have fire service controls mandatory
7. Maybe a requirement on buildings over 10 stories only.
8. Must be an independent system.
9. None

Appendix M:

Access Elevator March 29, 2016 Webinar Q and A Session Transcript

[Transcribed from full video recording of webinar available at https://vimeo.com/160784001]

Q: I was late joining the meeting. Did I hear you say the report is available on the commission website?

A: The report that was available was the interim report that we had put out last November. That was before survey results came out, but we did have the survey instrument there. That report will be in the appendix of an interim report. It was presented at the December 2nd Fire TAC meeting and you can go back through the archives of meetings at the Floridabuilding.org website and locate that. The final report which also will include all the survey results, comments that we received, the economic analysis – that will be available after May 15th. That will be submitted May 15th and will be presented to the various advisory committees sometime thereafter. So it will be available shortly after that.

Q: Is the loss of space to the lobby and elevator considered in the resulting space for profit sales?

A: Yes, so the question is, did we consider the loss of space? We did look at the space, we looked at the cost of that space, and it was looked at. Again the number came out for the whole project to be fairly small for what would be involved. We did try to look at that. When it came down to it, it was such a small number per square foot per month, lease or rent, we couldn't come up with a reasonable economic loss. The fluctuation in day-to-day market probably exceeded that cost on a typical project. Now we know when you start out designing the project – you're the architect of that project and you are looking at this space and trying to still meet your program – we know that's a challenge. But, nonetheless, we couldn't come up with enough of a cost to come up with an economic loss.

Q: Will the power point be made available? (X2)

A: Yes, this presentation is being recorded so this power point will be made available. We did find one error, we may change that before we make it available.

Q: Are there Florida fire incidences that have raised concern regarding the need for a second fire access elevator?

A: Since… even a single fire access elevator was only implemented in recent years there is no case record basically indicating the benefit of having the one, let alone having the two. So these are cases that something may occur down the road. So… we don't have any record of that.

Q: When will the continuing education credits be posted on the AIA?

A: We did not. That is something between you and AIA. We did not offer any CEUs for this presentation.

Q: How did the legislature arrive at 120'?

A: The 120' originally came from the International Building Code. The International Code Council set that as the number so that has come forward from that base code that we use. The legislature mainlined that in part …for the lobby altering requirement which gave a little more flexibility than the IBC had, and just kept the IBC language fully intact pretty much when it got to be over 420'.

Q: What is meant by "second elevator is not required" for what constraints?

A: We had an early slide that indicated that if your building only was going to have one elevator – maybe by code, design, you only needed one elevator in your building – you do not need to install a second elevator. If you have two or more elevators in a 12 story building, a building over 120' I should say, you will need to make two of those elevators fire service access elevators when the code goes fully into effect in 2017, unless the building commission changes that or the legislator changes that. Hope that answered it. You can respond back if that answered your question, if that was what you were asking for.

> *Participant response: Yes, that answered the question.*

Q: The economic benefit analysis assumes an elastic model. Any required additional cost would indicate economic benefit. If the cost impact is not quantifiable, the economic benefit is not valid.

A: When we did this for residential we were able to quantify that cost. And so you can look at this and say it's not valid because we were unable to show the other side of this. We're showing the one side. If someone wants to come up with the other side, you can do that. As we indicated, we tried to do that….spent a little bit of time looking at cost, looking at what places would lease for, and it came out too small to do that. We don't make a huge emphasis on the economics of elevator down-stream cost. We show what we've done. We show the survey costs. You can come to that conclusion if you choose to.

Q: Did I hear correctly that any continuing education credit must be reported by the participant?

A: That's correct. This webinar is just a webinar for sharing the results and getting input. We have not sought any credits through any organization.

Appendix N:
Statewide Direct, Indirect and Induced Economic Impact Report

A Review of the Economic Impact of changes in Florida Building code on the State of Florida

To

Robin Vieira, Director, UCF FSEC

By
Vernet Lasrado, Ph.D.

March 8, 2016

EXECUTIVE SUMMARY

The work performed measures the economic impact of incorporating into code those elements that were delayed by the 2015 legislative action. As a result of the changes in Florida building code there will be a change in the number of related jobs and a change in the resulting household expenses. The survey result data and industry impacts is used to determine total economic impact which is a sum of the direct, indirect, and induced economic impact. There are two elements to these costs. One is the increased expenditure on labor and equipment due to the code change that results in job growth, and the other is the decrease in home or unit sales due to the price increase which would result in job depletion. For the costs associated with these changes and price sensitivity to sales, the models indicate net benefits.

We use IMPLAN® Version 3.0 software to perform the analysis. One of the most powerful aspects of IMPLAN® is that models for specific regional economies can be created. Rather than extrapolating regional data from national averages, IMPLAN® measures economic impacts from data representing actual local economies. The table below presents a summary of the estimated economic impact.

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	202	$10,148,307	$13,055,844	$27,125,930
Indirect Effect	252	$12,289,900	$17,811,783	$35,091,479
Induced Effect	159	$7,045,767	$12,713,278	$21,699,887
Total Effect	613	$29,483,974	$43,580,905	$83,917,296

As it can be seen, the net impact of the code changes is positive. All estimates presented are for a single year.

- In terms of employment, the code changes will sustain an estimated 613 jobs[1] ($48K/job) of which
    - 202 jobs[2] ($50K/job) are directly sustained as a result of code changes
    - 252 jobs[3] ($48K/job) are indirectly sustained as a result of code changes
    - 159 jobs[4] ($44K/job) sustained are induced as a result of code changes
- The value added portion represents the Gross State Product (GSP). The code changes will add an estimated $43.5M of GSP of which
    - $13.0M of GSP are generated as a direct effect of code changes
    - $17.8M of GSP are generated as an indirect effect of code changes
    - $12.7M of GSP are generated as an induced effect of code changes

[1] Average annual salary for total jobs sustained is $48,074

[2] Average annual salary for direct jobs sustained is $50,364

[3] Average annual salary for indirect jobs sustained is $48,692

[4] Average annual salary for induced jobs sustained is $44,202

- The output portion represents the regional sales. The code changes will add an estimated $83.9M of regional sales of which
  - $27.1M of regional sales are generated as a direct effect of code changes
  - $35.0M of regional sales are generated as an indirect effect of code changes
  - $21.6M of regional sales are generated as an induced effect of code changes
- The taxes returned to the state and local governments are estimated at a net increase of $2.7M.

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1 INTRODUCTION

The work performed measures the economic impact of the delayed code provisions. As a result of the changes in Florida building code there will be a change in the number of related jobs and a change in the resulting household expenses. This report estimates total economic impact which is a sum of the direct, indirect, and induced economic impact.

The economic impact is modelled for the 3 code changes below.

1. The requirement for two fire service access elevators in Section 403.6.1, Building volume (referred to as High Rise Buildings – Elevator Code)
2. Mandatory Residential Air Tightness Testing (i.e., blower door testing) as found in section R402.4.1.2, Energy Conservation volume (referred to as Air Leakage and Blower door)
3. Residential Whole House Mechanical Ventilation Requirements as found in Section R303.4, Residential volume (referred to as Mechanical Vent)

2 METHODOLOGY

In essence, this study models the economic impact of the changes in building code on the State of Florida. These economic impacts are reported in the form of direct impact, indirect impact, and induced impact. The following section will detail the constraints of the study, the assumptions made, data collection endeavor, a summary of the collected/reported data, and the analysis technique.

2.1 Constraints of the study

2.1.1 Type of industry modelled

For the high rise projects we model the construction of new non-residential commercial and healthcare structures. For the air leakage, blower door, and mechanical vent projects we model the construction of new residential permanent site single and multifamily structures.

2.1.2 Study Period

The current study encompasses the period of a single year of the code being enforced.

2.1.3 Study Area

The study area is the State of Florida.

2.1.4 Software Used

The current study uses IMPLAN version 3. The use of IMPLAN reflects the general trend towards its application by multiple departments within the UCF Office of Research and Commercialization thereby leading to a more standardized output across the reports generated.

2.2 Data collection and assimilation

UCF FSEC conducted two industry surveys to estimate the costs as presented below. Subject matter experts were also consulted to build industry wide estimates of changes or effects.

2.3 Assumptions and Calculations

2.3.1 High Rise Buildings – Elevator Code (Section 403.6.1)

2.3.1.1 Assumptions

We estimate the number of buildings over 12 floors that are built each year. This estimate is built by capturing all the skyscrapers listed for each city listed for the State of Florida[5]. Then, after eliminating any duplicates, the total number of buildings constructed / year and the total number of buildings constructed / year that have greater than or equal to 12 floors is estimated for the periods specified in the table below.

Table 2-1: Annual Average High Rise construction in Florida

Annual Average	All Construction	≥ 12 Floors
All years	17.1	14.8
2016	44.0	44.0
2000-2016	34.1	30.6
1980-1999	19.9	17.7
1960-1979	21.0	17.9
Before 1960	2.5	1.5

An estimate of 34 buildings (2000-2016 annual average) constructed per year is used as the basis for this study.

The median subcontractor costs from the industry survey are used as the basis for the increased construction activity. This increased cost, largely labor, is a gain to the economy. The subcontractor cost is modelled as an increase in the construction of new nonresidential commercial and healthcare structures.

[5] Entire list can be found at http://skyscraperpage.com/database/state/52

2.3.1.2 Economic Calculations

The key survey question (question 8) presented an example12-story building description and asked
"For this project then, what is your best estimate of the additional cost ($) for making a second elevator fire-service access compliant (assume it is being served by the same lobby as the other fire service access elevator)?"

Two responses with a cost of 0 were eliminated. Median of 52 respondents with 1 or more FSAE jobs is $100,000. Median of 25 respondents with 5 or more FSAE
Jobs of $82,000 is used for the analysis

A second question (question 11a) targeted the case where an entire second elevator lobby might be needed. "What if there was another 12-story project being planned with one passenger elevator (a fire service access elevator) and one service/maintenance elevator serving a different lobby. What would be your estimate of the additional costs to convert the service elevator lobby into a fire service access elevator lobby? "

Two responses with a cost of 0 were removed from analysis. Median of 49 respondents with 1 or more FSAE jobs of $85,009. Median of those with 5 or more FSAE jobs of $100,000 is used for the analysis. Respondents were also asked for their buildings how often would this occur (question 11b).

"If the code already required two fire access elevators at the time a project begins, how often would a second lobby for a fire service access elevator be required for your typical projects (estimated % of projects requiring an additional fire service access lobby)?

The answers ranged from 0 to 100% with an average of 22.7% for 56 respondents.

Here only 22.7% of Question 11a will be used as this cost is only incurred 22.7% of the time as per the survey. The table below presents the cost to be used for the analysis. The 'use' and 'local' percentage columns indicate the amount of the median cost to attribute to the total cost. The total cost is derived by multiplying all the columns.

Table 2-2: Estimated construction cost gained due to Section 403.6.1

	Projects	Use %	Median Cost	Local %	Total Cost
Answer (8)	34	100	$82,000	100	$2,788,000
Answer (11)	34	22.7	$100,000	100	$771,800

These estimated costs are viewed as a gain to the economy and are modelled as such.

It is unclear what, if any, loss in revenue for a building owner would result from these increased costs. As a percentage of the overall high-rise structure cost, the increased costs of a 2nd FSAE costs are a very small fraction.

2.3.2 Air Leakage (Section R402.4.1.2)

2.3.2.1 Assumptions

We model the impact of increased expenditure in the construction field by contractors doing the work. Here, subcontractors are hired to seal the home, and other subcontractors conduct a blower door (air-tightness) test. The median subcontractor costs from the industry survey are used as the basis for the increased construction activity. This increased cost, largely labor, is a gain to the economy. The home builder/contractor has a gross margin which is assumed to be 20% over the subcontractor charged cost. The subcontractor cost is modelled as an increase in the construction of new residential permanent site single and multifamily structures. The gross margin is modelled as an increase in the industry spending pattern. The logic here is that the gross margin will increase the contactor's ability to spend money thereby result in an increase in the spending pattern of the industry. It is estimated that there will be 70,000 such projects a year based on recent Florida housing starts[6].

As a result of the increased costs the overall cost of each new home increases. This results in lost sales as people get priced out of buying a house. For $1000 increase in price increase 125 fewer Florida new homes are sold[7]. Further, for the state of Florida it is estimated that the median sales price of a new homes is $319,174[8] of which for this study $211,298 is attributed to construction costs and $45,000 is attributed to gross margin with the remaining in fees and site expenses[9]. Hence, for each house not sold the construction cost lost is modelled as a decrease in the construction of new residential permanent site single and multifamily structures while gross margin lost is modelled as a reduction in the industry spending pattern.

This industry data will also be used to estimate the cost for the Air Blower code change.

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[6] Correspondence with David Crowe at NAHB indicated 56,300 Florida housing starts in 2014, FSEC raised this to 70,000 housing starts as a more typical number. Results are linear so for a change in housing starts estimates, divide economic result by 70,000 and ultiply by your preferred housing start estimate.

[7] According to communication with David Crowe at the National Association of Homebuilders

[8] Ibid, unpublished data

[9] Amounts vary but these estimates seemed reasonable for some parts of the state according to Mike Hickman of Hickman Homes

2.3.2.2 Calculations

There were two survey questions regarding air sealing. *How much money is currently being spent to seal the home, and a second question where respondents estimated how much more might be required to achieve the level requested by tested performance in the code.*

The question regarding existing sealing costs for a sample house provided was "Estimate the cost ($) to the builder for typical air sealing measures for the EXAMPLE HOUSE built to the Florida Code's MINIMUM REQUIREMENTS."

The survey had 135 respondents with one or more jobs of experience that indicated a median cost of $600. Of the 56 respondents with over 20 jobs of experience the median cost was $500. This cost was not modelled as it is the existing code cost not the cost of increased code changes.

The second question was "Would any additional air sealing be necessary to reach the required blower door test result of no greater than 5 ACH50?" 154 respondents said no, and 171 indicated yes. Fifty of those answering yes indicated a median cost of $500, which was also the median of the 23 respondents with over 20 jobs of experience.

From the responses, the median cost used is $500 for those respondents who thought that additional air sealing was necessary. This cost is used towards labor, material, and equipment. The percentages of cost (cost % column) attributed to each are indicated in the table below. The 'local' percentage columns indicate the amount of the median cost for that row to attribute to the total cost. These percentages were determined by a panel of industry experts. The total cost is derived by multiplying all the columns.

Table 2-3: Estimated construction cost gained due to Air Leakage (Section R402.4.1.2)

	Projects	Cost %	Median Cost	Local %	Total Cost
Labor	70000	80	$500	100	$28,000,000
Materials	70000	15	$500	100	$5,250,000
Equipment	70000	5	$500	100	$1,750,000

These estimated costs are viewed as a gain to the economy. The total construction cost gained is estimated to be $35,000,000. Given the gross margin is 20%; the estimated gross profit gained by the builders is $7,000,000[10].

Given the median cost of $500 and a markup of 20%, the cost of the home is expected to rise by $600. As stated earlier, for $1000 increase in price increase 125 fewer new Florida homes are

[10] 70,000*$500*0.2

sold. Therefore, a $600 increase in price will result in 75 fewer homes being sold. As stated earlier, the new homes price $319,174 of which for this study $211,298 is attributed to construction costs and $45,000 is attributed to gross margin. Hence, the total construction cost lost is estimated to be $15,847,350[11] and estimated gross profit lost by the builder is $3,375,000. This is summarized below.

Table 2-4: Summary of estimated costs due to Air Leakage (Section R402.4.1.2)

	Gained	Lost
Construction Cost	$35,000,000	- $15,847,350
Profit	$7,000,000	-$3,375,000

2.3.3 Blower Door (Section R402.4.1.2)

2.3.3.1 Assumptions

Same as Section 2.3.2.1

2.3.3.2 Calculations

The response to the following question was used for the economic analysis: "*Estimate the cost to builder for conducting a blower door test and all associated reporting and communications for the EXAMPLE HOUSE assuming it is within the tester's normal service area"*

The survey had 134 respondents indicate a median cost of $350. The median dropped to $300 among those indicating 20 or more jobs of experience. From the responses, the median cost used is $300. This cost is used towards labor, material, and equipment. The percentages of cost (cost % column) attributed to each are indicated in the table below. The 'local' percentage columns indicate the amount of the median cost for that row to attribute to the total cost. These percentages were determined by a panel of industry experts. The total cost is derived by multiplying all the columns.

Table 2-5: Estimated construction cost gained due to Blower Door (Section R402.4.1.2)

	Projects	Cost %	Median Cost	Local %	Total Cost
Labor	70000	95	$300	100	$19,950,000
Materials	-	-	-	-	-
Equipment	70000	5	$300	50	$1,050,000

[11] 75*$211,298

These estimated costs are viewed as a gain to the economy. The total construction cost gained is estimated to be $21,000,000. Given the gross margin is 20%; the estimated profit gained by the sub-contractors is $4,200,000.

Given the median cost of $300 and a markup of 20%, the cost of the home is expected to rise by $360 which will result in 45 fewer new Florida homes being sold. The total construction cost lost is estimated to be $9,508,410 and estimated profit lost by the builder is $2,025,000. This is summarized below.

Table 2-6: Summary of estimated costs due to Blower Door (Section R402.4.1.2)

	Gained	Lost
Construction Cost	$21,000,000	-$9,508,410
Profit	$4,200,000	-$2,025,000

2.3.4 Mechanical Vent (Section R303.4)

2.3.4.1 Assumptions

Same as Section 2.3.2.1

2.3.4.2 Calculations

Respondents were asked to estimate the costs of installing a mechanical ventilation system for the example house:

> *"Estimated cost ($) of this system to the builder including equipment and installation"*

The survey had 141 respondents with one or more jobs of experience that indicated a median cost of $800. The median dropped to $500 among those indicating experience with 10 or more jobs.

From the responses, the median cost used is $500. This cost is used towards labor, material, and equipment. The percentages of cost (cost % column) attributed to each are indicated in the table below. The 'local' percentage columns indicate the amount of the median cost for that row to attribute to the total cost. These percentages were determined by a panel of industry experts. The total cost is derived by multiplying all the columns.

Table 2-7: Estimated construction cost gained due to Mechanical Vent (Section R303.4)

	Projects	Cost %	Median Cost	Local %	Total Cost
Labor	70000	50	$500	50	$8,750,000
Materials	70000	50	$500	25	$4,375,000
Equipment	-	-	-	-	-

These estimated costs are viewed as a gain to the economy. The total construction cost gained is estimated to be $13,125,000. Given the gross margin is 20%; the estimated gross profit gained by the builders is $7,000,000.

Given the median cost of $500 and a markup of 20%, the cost of the home is expected to rise by $600 which will result in 75 fewer new Florida homes being sold. The total construction cost lost is estimated at $15,847,350 and estimated gross profit lost by the builder is $3,375,000. This is summarized below.

Table 2-8: Summary of estimated costs due to Mechanical Vent (Section R303.4)

	Gained	Lost
Construction Cost	$13,125,000	-$15,847,350
Profit	$7,000,000	-$3,375,000

2.3.5 Ventilation Additional HAC Costs (Section R303.4)

2.3.5.1 Assumptions

Same as Section 2.3.2.1

2.3.5.2 Calculations

When a mechanical ventilation system is installed many builders or HVAC subcontractors will also change features of the rest of the HVAC system in order to meet peak demands or reduce moisture loads. The survey attempted to capture this by asking "*If you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE, please estimate the cost and describe the changes needed.*"

The survey had 74 respondents with one or more jobs of experience that indicated a median cost of $1,000. The median dropped to $800 among the 29 people answering with 10 or more jobs of experience. However, the survey had 128 total respondents, 54 who indicated no additional costs, bringing the overall median to $425. There were 61 respondents with 10 or more jobs, with 32 indicating no cost bringing the median to zero. For the sake of the economic analysis we will calculate the totals based on those respondents who indicated cost, but the results should be applied appropriately.

From the responses, the median cost used is $800. This cost is used towards labor, material, and equipment. The percentages of cost (cost % column) attributed to each are indicated in the table below. The 'local' percentage columns indicate the amount of the median cost for that row to attribute to the total cost. These percentages were determined by a panel of industry experts. The total cost is derived by multiplying all the columns.

Table 2-9: Estimated construction cost gained due to Ventilation Additional HAC Costs (Section R303.4)

	Projects	Cost %	Median Cost	Local %	Total Cost
Labor	70000	50	$800	50	$14,000,000
Materials	70000	50	$800	25	$7,000,000
	-	-	-	-	-

These estimated costs are viewed as a gain to the economy. The total construction cost gained is estimated to be $21,000,000. Given the gross margin is 20%; the estimated gross profit gained by the builders is $11,200,000.

Given the median cost of $800 and a markup of 20%, the cost of the home is expected to rise by $960 which will result in 120 fewer homes being sold. The total construction cost lost is estimated to be $25,355,760 and estimated gross profit lost by the builder is $5,400,000. This is summarized below.

Table 2-10: Summary of estimated costs due to Ventilation Additional HAC Costs (Section R303.4)

	Gained	Lost
Construction Cost	$21,000,000	-$25,355,760
Profit	$11,200,000	-$5,400,000

2.4 Summary cost estimates as reported by the FSEC

The table below presents the costs estimated as described in Section 2.3. These costs will be used as the input data for IMPLAN.

Table 2-11: Summary of cost estimates resulting from proposed code changes

Code	Response	Gained	Lost
Elevator- Highrise (403.6.1)	Answer (08)	$2,788,000	
Elevator- Highrise (403.6.1)	Answer (11)	$771,800	
Air Leakage (R402.4.1.2)	Construction Cost	$35,000,000	-$15,847,350
Air Leakage (R402.4.1.2)	Gross Margin	$7,000,000	-$3,375,000
Blower Door (R402.4.1.2)	Construction Cost	$21,000,000	-$9,508,410
Blower Door (R402.4.1.2)	Gross Margin	$4,200,000	-$2,025,000
Mechanical Vent (R303.4)	Construction Cost	$13,125,000	-$15,847,350
Mechanical Vent (R303.4)	Gross Margin	$7,000,000	-$3,375,000
Mech Vent Additional (R303.4)	Construction Cost	$21,000,000	-$25,355,760
Mech Vent Additional (R303.4)	Gross Margin	$11,200,000	-$5,400,000
	Total	$123,084,800	-$80,733,870

3 RESULTS

3.1 Overall Summary

Table 3-1: Summary of Results

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	202	$10,148,307	$13,055,844	$27,125,930
Indirect Effect	252	$12,289,900	$17,811,783	$35,091,479
Induced Effect	159	$7,045,767	$12,713,278	$21,699,887
Total Effect	613	$29,483,974	$43,580,905	$83,917,296

It is estimated that the net 202 sustained jobs resulting from the code changes would result in another 252 indirect jobs and 159 induced jobs, for a total of 613 jobs sustained, leading to $43.5M in GDP and $83.9M in statewide spending with an estimated $2.7M returned to state and local governments in the form of taxes.

The following section will present this information in greater detail with respect to the economic impact of the proposed code changes modelled.

3.2 Breakdown by Code Change

3.2.1 Jobs Sustained

Table 3-2: Direct Effect of code changes on Jobs Sustained

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	27	0	27
Elevator- Highrise (403.6.1)	Answer (11)	7	0	7
Air Leakage (R402.4.1.2)	Construction Cost	249	-113	136
Air Leakage (R402.4.1.2)	Profit	0	0	0
Blower Door (R402.4.1.2)	Construction Cost	149	-68	82
Blower Door (R402.4.1.2)	Profit	0	0	0
Mechanical Vent (R303.4)	Construction Cost	93	-113	-19
Mechanical Vent (R303.4)	Profit	0	0	0
Mech Vent Additional (R303.4)	Construction Cost	149	-180	-31
Mech Vent Additional (R303.4)	Profit	0	0	0
	Total	675	-473	**202**

Table 3-3: Indirect Effect of code changes on Jobs Sustained

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	7	0	7
Elevator- Highrise (403.6.1)	Answer (11)	2	0	2
Air Leakage (R402.4.1.2)	Construction Cost	122	-55	67
Air Leakage (R402.4.1.2)	Profit	74	-36	38
Blower Door (R402.4.1.2)	Construction Cost	73	-33	40
Blower Door (R402.4.1.2)	Profit	45	-22	23
Mechanical Vent (R303.4)	Construction Cost	46	-55	-10
Mechanical Vent (R303.4)	Profit	74	-36	38
Mech Vent Additional (R303.4)	Construction Cost	73	-89	-15
Mech Vent Additional (R303.4)	Profit	119	-57	62
	Total	635	-383	**252**

Table 3-4: Induced Effect of code changes on Jobs Sustained

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	12	0	12
Elevator- Highrise (403.6.1)	Answer (11)	3	0	3
Air Leakage (R402.4.1.2)	Construction Cost	130	-59	71
Air Leakage (R402.4.1.2)	Profit	26	-13	13
Blower Door (R402.4.1.2)	Construction Cost	78	-35	43
Blower Door (R402.4.1.2)	Profit	16	-8	8
Mechanical Vent (R303.4)	Construction Cost	49	-59	-10
Mechanical Vent (R303.4)	Profit	26	-13	13
Mech Vent Additional (R303.4)	Construction Cost	78	-94	-16
Mech Vent Additional (R303.4)	Profit	42	-20	22
	Total	459	-299	**159**

3.2.2 Labor Income Impact

Table 3-5: Direct Effect of code changes on labor Income

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$1,352,198	$0	$1,352,198
Elevator- Highrise (403.6.1)	Answer (11)	$374,328	$0	$374,328
Air Leakage (R402.4.1.2)	Construction Cost	$12,507,880	-$5,663,336	$6,844,544
Air Leakage (R402.4.1.2)	Profit	$0	$0	$0
Blower Door (R402.4.1.2)	Construction Cost	$7,504,728	-$3,398,001	$4,106,727
Blower Door (R402.4.1.2)	Profit	$0	$0	$0
Mechanical Vent (R303.4)	Construction Cost	$4,690,455	-$5,663,336	-$972,881
Mechanical Vent (R303.4)	Profit	$0	$0	$0
Mech Vent Additional (R303.4)	Construction Cost	$7,504,728	-$9,061,337	-$1,556,609
Mech Vent Additional (R303.4)	Profit	$0	$0	$0
	Total	$33,934,317	-$23,786,010	**$10,148,307**

Table 3-6: Indirect Effect of code changes on labor Income

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$378,536	$0	$378,536
Elevator- Highrise (403.6.1)	Answer (11)	$104,790	$0	$104,790
Air Leakage (R402.4.1.2)	Construction Cost	$5,743,518	-$2,600,558	$3,142,960
Air Leakage (R402.4.1.2)	Profit	$3,650,280	-$1,759,956	$1,890,324
Blower Door (R402.4.1.2)	Construction Cost	$3,446,111	-$1,560,335	$1,885,776
Blower Door (R402.4.1.2)	Profit	$2,190,168	-$1,055,974	$1,134,194
Mechanical Vent (R303.4)	Construction Cost	$2,153,819	-$2,600,558	-$446,739
Mechanical Vent (R303.4)	Profit	$3,650,280	-$1,759,956	$1,890,324
Mech Vent Additional (R303.4)	Construction Cost	$3,446,111	-$4,160,893	-$714,782
Mech Vent Additional (R303.4)	Profit	$5,840,447	-$2,815,930	$3,024,517
	Total	$30,604,060	-$18,314,160	**$12,289,900**

Table 3-7: Indirect Effect of code changes on labor Income

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$544,958	$0	$544,958
Elevator- Highrise (403.6.1)	Answer (11)	$150,860	$0	$150,860
Air Leakage (R402.4.1.2)	Construction Cost	$5,729,357	-$2,594,146	$3,135,211
Air Leakage (R402.4.1.2)	Profit	$1,145,871	-$552,474	$593,397
Blower Door (R402.4.1.2)	Construction Cost	$3,437,614	-$1,556,488	$1,881,126
Blower Door (R402.4.1.2)	Profit	$687,523	-$331,484	$356,039
Mechanical Vent (R303.4)	Construction Cost	$2,148,509	-$2,594,146	-$445,637
Mechanical Vent (R303.4)	Profit	$1,145,871	-$552,474	$593,397
Mech Vent Additional (R303.4)	Construction Cost	$3,437,614	-$4,150,634	-$713,020
Mech Vent Additional (R303.4)	Profit	$1,833,394	-$883,958	$949,436
	Total	$20,261,571	-$13,215,804	**$7,045,767**

3.2.3 Value Added – Gross State Product (GSP)

Table 3-8: Direct Effect of code changes on GSP (Value added)

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$1,443,603	$0	$1,443,603
Elevator- Highrise (403.6.1)	Answer (11)	$399,632	$0	$399,632
Air Leakage (R402.4.1.2)	Construction Cost	$16,652,767	-$7,540,063	$9,112,704
Air Leakage (R402.4.1.2)	Profit	$0	$0	$0
Blower Door (R402.4.1.2)	Construction Cost	$9,991,660	-$4,524,038	$5,467,622
Blower Door (R402.4.1.2)	Profit	$0	$0	$0
Mechanical Vent (R303.4)	Construction Cost	$6,244,787	-$7,540,063	-$1,295,276
Mechanical Vent (R303.4)	Profit	$0	$0	$0
Mech Vent Additional (R303.4)	Construction Cost	$9,991,660	-$12,064,101	-$2,072,441
Mech Vent Additional (R303.4)	Profit	$0	$0	$0
	Total	$44,724,109	-$31,668,265	**$13,055,844**

Table 3-9: Indirect Effect of code changes on GSP (Value added)

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$557,139	$0	$557,139
Elevator- Highrise (403.6.1)	Answer (11)	$154,232	$0	$154,232
Air Leakage (R402.4.1.2)	Construction Cost	$8,893,168	-$4,026,661	$4,866,507
Air Leakage (R402.4.1.2)	Profit	$5,109,187	-$2,463,358	$2,645,829
Blower Door (R402.4.1.2)	Construction Cost	$5,335,901	-$2,415,997	$2,919,904
Blower Door (R402.4.1.2)	Profit	$3,065,512	-$1,478,015	$1,587,497
Mechanical Vent (R303.4)	Construction Cost	$3,334,938	-$4,026,661	-$691,723
Mechanical Vent (R303.4)	Profit	$5,109,187	-$2,463,358	$2,645,829
Mech Vent Additional (R303.4)	Construction Cost	$5,335,901	-$6,442,658	-$1,106,757
Mech Vent Additional (R303.4)	Profit	$8,174,699	-$3,941,373	$4,233,326
	Total	$45,069,864	-$27,258,081	**$17,811,783**

Table 3-10: Induced Effect of code changes on GSP (Value added)

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$983,396	$0	$983,396
Elevator- Highrise (403.6.1)	Answer (11)	$272,233	$0	$272,233
Air Leakage (R402.4.1.2)	Construction Cost	$10,337,872	-$4,680,796	$5,657,076
Air Leakage (R402.4.1.2)	Profit	$2,067,574	-$996,866	$1,070,708
Blower Door (R402.4.1.2)	Construction Cost	$6,202,723	-$2,808,478	$3,394,245
Blower Door (R402.4.1.2)	Profit	$1,240,544	-$598,120	$642,424
Mechanical Vent (R303.4)	Construction Cost	$3,876,702	-$4,680,796	-$804,094
Mechanical Vent (R303.4)	Profit	$2,067,574	-$996,866	$1,070,708
Mech Vent Additional (R303.4)	Construction Cost	$6,202,723	-$7,489,274	-$1,286,551
Mech Vent Additional (R303.4)	Profit	$3,308,119	-$1,594,986	$1,713,133
	Total	$36,559,460	-$23,846,182	**$12,713,278**

3.2.4 Economic output generated - Regional Sales

Table 3-11: Direct Effect of code changes on Regional Sales (Economic Output)

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$2,788,000	$0	$2,788,000
Elevator- Highrise (403.6.1)	Answer (11)	$771,800	$0	$771,800
Air Leakage (R402.4.1.2)	Construction Cost	$35,000,000	-$15,847,350	$19,152,650
Air Leakage (R402.4.1.2)	Profit	$0	$0	$0
Blower Door (R402.4.1.2)	Construction Cost	$21,000,000	-$9,508,410	$11,491,590
Blower Door (R402.4.1.2)	Profit	$0	$0	$0
Mechanical Vent (R303.4)	Construction Cost	$13,125,000	-$15,847,350	-$2,722,350
Mechanical Vent (R303.4)	Profit	$0	$0	$0
Mech Vent Additional (R303.4)	Construction Cost	$21,000,000	-$25,355,760	-$4,355,760
Mech Vent Additional (R303.4)	Profit	$0	$0	$0
	Total	$93,684,800	-$66,558,870	**$27,125,930**

Table 3-12: Indirect Effect of code changes on Regional Sales (Economic Output)

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$1,082,537	$0	$1,082,537
Elevator- Highrise (403.6.1)	Answer (11)	$299,678	$0	$299,678
Air Leakage (R402.4.1.2)	Construction Cost	$16,677,763	-$7,551,381	$9,126,382
Air Leakage (R402.4.1.2)	Profit	$10,335,552	-$4,983,213	$5,352,339
Blower Door (R402.4.1.2)	Construction Cost	$10,006,658	-$4,530,829	$5,475,829
Blower Door (R402.4.1.2)	Profit	$6,201,331	-$2,989,928	$3,211,403
Mechanical Vent (R303.4)	Construction Cost	$6,254,161	-$7,551,381	-$1,297,220
Mechanical Vent (R303.4)	Profit	$10,335,552	-$4,983,213	$5,352,339
Mech Vent Additional (R303.4)	Construction Cost	$10,006,658	-$12,082,210	-$2,075,552
Mech Vent Additional (R303.4)	Profit	$16,536,884	-$7,973,140	$8,563,744
	Total	$87,736,774	-$52,645,295	**$35,091,479**

Table 3-13: Induced Effect of code changes on Regional Sales (Economic Output)

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$1,678,416	$0	$1,678,416
Elevator- Highrise (403.6.1)	Answer (11)	$464,634	$0	$464,634
Air Leakage (R402.4.1.2)	Construction Cost	$17,645,509	-$7,989,558	$9,655,951
Air Leakage (R402.4.1.2)	Profit	$3,529,102	-$1,701,531	$1,827,571
Blower Door (R402.4.1.2)	Construction Cost	$10,587,305	-$4,793,735	$5,793,570
Blower Door (R402.4.1.2)	Profit	$2,117,461	-$1,020,919	$1,096,542
Mechanical Vent (R303.4)	Construction Cost	$6,617,066	-$7,989,558	-$1,372,492
Mechanical Vent (R303.4)	Profit	$3,529,102	-$1,701,531	$1,827,571
Mech Vent Additional (R303.4)	Construction Cost	$10,587,305	-$12,783,294	-$2,195,989
Mech Vent Additional (R303.4)	Profit	$5,646,563	-$2,722,450	$2,924,113
	Total	$62,402,463	-$40,702,576	**$21,699,887**

3.3 Total State and Local Taxes Generated

Table 3-14: Total State and Local Tax generated by code changes

Code	Response	Gained	Lost	Total
Elevator- Highrise (403.6.1)	Answer (08)	$156,822	$0	$156,822
Elevator- Highrise (403.6.1)	Answer (11)	$43,413	$0	$43,413
Air Leakage (R402.4.1.2)	Construction Cost	$2,295,888	-$1,039,535	$1,256,353
Air Leakage (R402.4.1.2)	Profit	$459,177	-$221,388	$237,789
Blower Door (R402.4.1.2)	Construction Cost	$1,377,533	-$623,722	$753,811
Blower Door (R402.4.1.2)	Profit	$275,506	-$132,833	$142,673
Mechanical Vent (R303.4)	Construction Cost	$860,959	-$1,039,535	-$178,576
Mechanical Vent (R303.4)	Profit	$459,177	-$221,388	$237,789
Mech Vent Additional (R303.4)	Construction Cost	$1,377,533	-$1,663,256	-$285,723
Mech Vent Additional (R303.4)	Profit	$734,685	-$354,222	$380,463
	Total	$8,040,693	-$5,295,879	**$2,744,814**

4 APPENDIX A: SURVEY QUESTIONS AND RESPONSES

4.1 High Rise Building Elevators (Section 403.6.1)

The survey had an example building to which respondents answered the questions as listed below

4.1.1 Example project description

Please provide an estimate of additional cost for a new project for which planning is just beginning. The project calls for three elevators for a 12-story office tower with interior lobbies and corridors. Under Florida 2010 code, one elevator would be required to be a fire-service access elevator and the other two could be non-fire-service-access elevators. Under the 2014 Florida code language (the part delayed by the legislature), there would need to be 2 fire service-access elevators for this project.

4.1.2 Question 08

For this project then, what is your best estimate of the additional cost ($) for making a second elevator fire-service access compliant (assume it is being served by the same lobby as the other fire service access elevator)?

Here, we eliminated two responses with cost of 0. Median of 52 respondents with 1 or more FSAE jobs of $100,000 is used for the analysis. Median of 25 respondents with 5 or more FSAE jobs: $82,000

4.1.3 Question 11a

What if there was another 12-story project being planned with one passenger elevator (a fire service access elevator) and one service/maintenance elevator serving a different lobby. What would be your estimate of the additional costs to convert the service elevator lobby into a fire service access elevator lobby?

Here, we eliminated two responses with cost of 0. Median of 49 respondents with 1 or more FSAE jobs of $85,009 is used for the analysis. Median of those with 5 or more FSAE jobs:
$100,000

4.1.4 Question 11b

If the code already required two fire access elevators at the time a project begins, how often would a second lobby for a fire service access elevator be required for your typical projects (estimated % of projects requiring an additional fire service access lobby)?

The answers ranged from 0 to 100% with an average of 22.7% for 56 respondents.

4.2 Air Tightness and Blower door (Section R402.4.1.2)

The survey had an example house to which respondents answered the questions as listed below

4.2.1 Example house description

A new, Florida Code compliant, single-story, single family detached, concrete block house, all electric (heat pump, water heater, and all appliances), with 2,000 ft2 of conditioned area, 9' ceiling height, 3 bedrooms, and 2 baths.

4.2.2 Air Sealing

Estimate the cost ($) to the builder for typical air sealing measures for the EXAMPLE HOUSE built to the Florida Code's MINIMUM REQUIREMENTS.

The survey had 135 respondents with one or more jobs of experience that indicated a median cost of $600. Of the 56 respondents with over 20 jobs of experience the median cost was $500.

Would any additional air sealing be necessary to reach the required blower door test result of no greater than 5 ACH50? 154 respondents said no. and 171 indicated yes. Fifty of those answering yes indicated a median cost of $500, which was also the median of the 23 respondents with over 20 jobs of experience.

4.2.3 Blower Door

Estimate the cost to builder for conducting a blower door test and all associated reporting and communications for the EXAMPLE HOUSE assuming it is within the tester's normal service area

The survey had 134 respondents indicate a median cost of $350. The median dropped to $300 among those indicating 20 or more jobs of experience.

4.3 Mechanical Ventilation

The survey had an example house to which respondents answered the questions as listed below

4.3.1 Example house description

A new, Florida Code compliant, single-story, single family detached, concrete block house, all electric (heat pump, water heater, and all appliances), with 2,000 ft2 of conditioned area, 9' ceiling height, 3 bedrooms, and 2 baths.

4.3.2 Mechanical Ventilation System Cost

Estimated cost ($) of this system to the builder including equipment and installation

The survey had 141 respondents with one or more jobs of experience that indicated a median cost of $800. The median dropped to $500 among those indicating experience with 10 or more jobs.

4.3.3 Ventilation Additional HAC Costs

If you expect the selection or characteristics of the air conditioning and heating equipment to change with the addition of whole-house mechanical ventilation for the EXAMPLE HOUSE, please estimate the cost and describe the changes needed

The survey had 74 respondents with one or more jobs of experience that indicated a median cost of $1,000. The median dropped to $800 among the 29 people answering with 10 or more jobs of experience.

5 APPENDIX B: IMPLAN INFORMATION

What is IMPLAN?[12]

IMPLAN® is an acronym for IMpact analysis for PLANning. The IMPLAN® System is a general input-output model that is comprised of software and regional data sets. One of the most powerful aspects of IMPLAN®, is that input-output Models for specific regional economies can be created. Rather than extrapolating regional data from national averages, IMPLAN® measures economic impacts from data representing actual local economies. IMPLAN® data sets are available from the ZIP Code level to the national level, and regional files can be combined to create precise geographic definitions when calculating impacts. The analysis results provide the IMPLAN® user or client with a report that demonstrates the detailed effects of local changes on supporting industries and households. Reports can provide both detailed and summary information related to job creation, income, production, and taxes. IMPLAN® Version 3.0 can even track the impacts of a local change on surrounding regional economies.

IMPLAN® data tracks all the available industry groups in every level of the regional data. This permits detailed impact breakdowns and helps ensure accuracy of inter-industry relationships. If a study involves the introduction of an industry group that does not already exist in the local area, IMPLAN® provides tools to create a new industry. This new industry can be used as a proxy

[12] The following section contains excerpts from various sections of “Day, F. (2012). *Principles of Impact Analysis and IMPLAN Applications*. Davidson, NC, USA: MIG”

to estimate the likely impacts of the new industry's production to the local economy. And if the industry exists in IMPLAN®, but doesn't exactly match the sales and employment information for the industry being modeled, the IMPLAN® industry relationships may be updated to match the known values, while still maintaining the local regional sales and employment averages for examining the Indirect and Induced impacts.

Table 5-1: Definition of IMPLAN Terms

IMPLAN Term	Definition
Backward Linkages	The tracking of industry purchases backward through the supply chain.
Direct Impact	The initial expenditures, or production, made by the industry experiencing the economic change.
Indirect Impact	The effects of local inter-industry spending through the backward linkages.
Induced Impact	The results of local spending of employee's wages and salaries for both employees of the *Directly Impacted* industry, and the employees of the Indirectly affected industries.

Figure 5-1 illustrates the framework of the IMPAN model. Economic impact studies typically generate large amounts of information about local industries, employment, wages, profits, labor spending, and taxes that may be useful for a variety of purposes and circumstances. Most reports, therefore, seek to condense this information into a format that demonstrates the overall effect of the economic change as it relates to jobs or other monetary means, and in a manner that is meaningful to the report's intended audience.

To generate the detailed background information that supports the overall affects economic factors have on the local region, or even on surrounding regions, economic impact analysis looks backwards rather than forwards through the economy. In other words, to determine the effect of increased production in a local industry, economic analysis looks at the industries which supply the producing industry with the items and services that industry incorporates into its production.

So an increase in window production will result in the manufacturer purchasing a variety of supplies including wood, glass, and furnishings for the windows, all of which will be incorporated into the final product. Collectively, tracing the impacts back through the supply chain is tracing the *backward linkages*. Each supplier in the chain represents a backward linkage. Since each supplier of an industry has to purchase inputs from other suppliers in order to create their own products (e.g. the window furniture company has to purchase sheet metal from which it stamps out is parts), the accumulation of these backward linkages can be tracked until the resultant spending of the original impact is completely removed from the economy by imports, savings, taxes and profits.

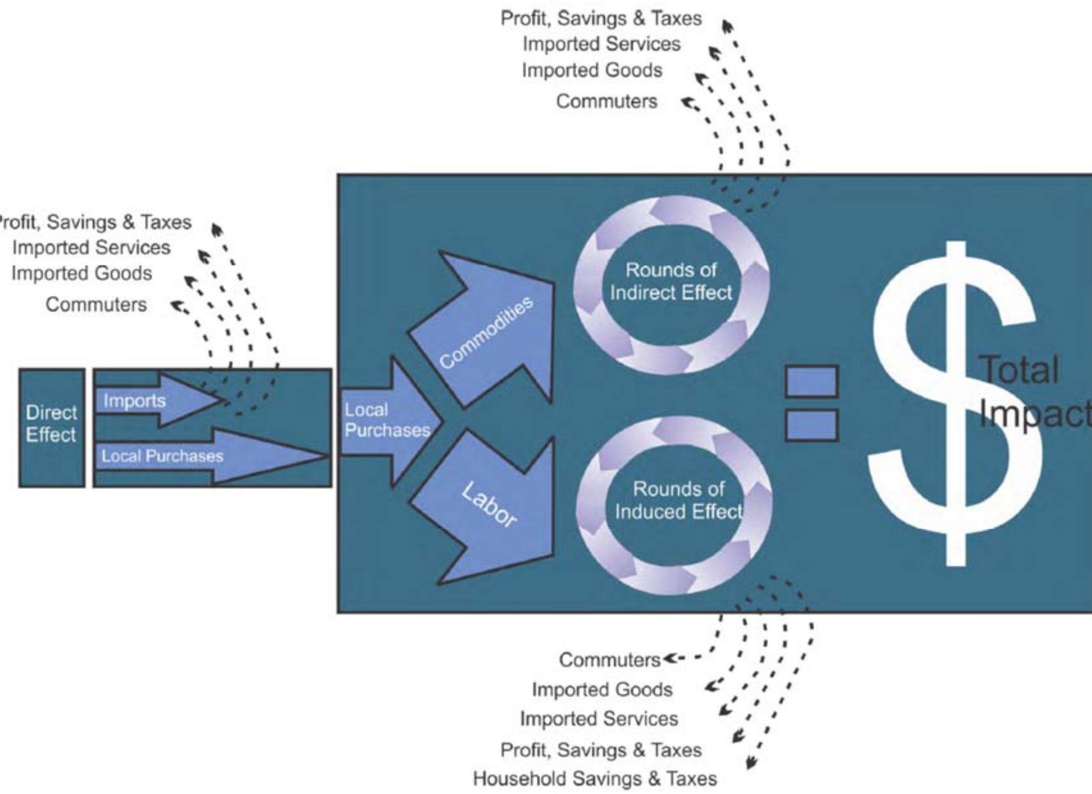

Figure 5-1: IMPLAN Model framework

These consecutive rounds of inter-industry spending traveling back through the supply chain are called the *Indirect Effects*. These impacts are "indirect" because the increase in these industry's production is stimulated by the increase of sales in another industry. Increases in production not only require an increase in purchases of supplies, but typically also require an increase in employment and/or labor spending. This increase in labor dollars also has traceable economic effects, because increased labor dollars typically translate into increased income spending. The pending of income earned by the employees, resulting from both *Directly and Indirectly affected* industries, contributes to the *Induced Effect*. The Induced Effect, therefore, is a measurement of employee spending of all employees of the *Directly affected* industry, and all the employees of subsequent Indirectly impacted industries in the supply chain, as long as these employees live within the defined geography of the study.

IMPLAN also reports on the State/Local Taxes collected as a result of the modeled scenario. In the *Employee Compensation* field, IMPLAN reports on the amount of the employer collected and paid social security taxes on wages. For, state/local taxes these values are mostly contributions to government retirement funds. Taxes on *Production and Imports* are collected by the businesses on behalf of the State and local governments. These taxes include sales tax, property tax, motor vehicle tax, severance tax, business licenses taxes, and documentary and stamp taxes.

Taxes reported under *Households* include personal income tax (none for Florida), personal vehicle fee payments, personal property taxes, fines, donations, and licensing fees. Taxes on *Corporations* include corporate tax payments on profits and dividends paid to governments on government investments.