

Best Practices for Conducting Energy Code Compliance Studies

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Executive Summary


As jurisdictions across the country continue to update and upgrade their building energy codes to improve durability, safety, comfort, energy usage, and sustainability, the question arises: are newly constructed buildings actually meeting the requirements in the new codes? To answer this, states, utilities, and the U.S. Department of Energy are teaming to conduct energy code compliance studies.

Recruiting adequate quantity of buildings for compliance studies is critical and the process must be efficient to support timelines and budget constraints. Just as pre-design planning is critical in the construction of commercial buildings, so is the time devoted to setting a recruitment strategy for the study. Each jurisdiction is different from another in how buildings are constructed, reviewed, and inspected. This drives us to ask:

- What does it take to recruit buildings to research during compliance studies?
- Who do you contact to get into the buildings?

Starting with the local building department is often the first step. The building department's level of familiarity and engagement with the energy code, as well as how the compliance study is presented to them can often determine their willingness to participate. Designers, contractors, building owners, commissioning agents, energy raters, and retired code officials can also play a part in helping to recruit buildings under construction. For a successful compliance study, most or all of these stakeholders may need to be leveraged during the study. As with the building department officials, how these stakeholders are approached, if they understand the benefits of the study, and how well their particular concerns are addressed will very strongly affect their willingness to participate. Ultimately, some of these stakeholders may be curious about how well their projects are complying with the energy code and how they can improve their role, as long as study results are anonymous and avoids placing blame.

Just as the energy code provides flexibility for compliance design so must the compliance assessor be flexible and nimble to adjust approaches from city to city or project to project.



Introduction

The adoption of the International Energy Conservation Code (IECC) and ASHRAE Standard 90.1 has increased across Colorado and other Southwest states since 2009 when the American Recovery and Reinvestment Act (ARRA) incentivized states to advance to the 2009 IECC. Most of the high-construction areas have since advanced to newer energy codes, such as the 2015 IECC. What continues to be the unknown is the level of compliance of newly constructed buildings.

Does new commercial building construction include the IECC requirements such as lighting controls, lighting power density based on space usage, correct window efficiency, and HVAC installation? Do the buildings also include appropriate levels of insulation, air barrier installation and many additional energy code and standard requirements?

In 2014, the U.S. Department of Energy (DOE) funded residential energy code compliance studies in six states over a three-year period to verify the level of compliance occurring in residential construction. The DOE through the Pacific Northwest National Laboratory (PNNL) also funded a small commercial compliance study in the Northwest. One focus area not addressed in these studies was the procedure and time required for researchers to enter buildings.

The PNNL commercial study found it challenging to first find buildings and then gain access to enter buildings and perform the study. A large portion of the budget was dedicated to recruiting buildings.

Assessing code compliance for residential and commercial buildings is difficult and this report helps organizations perform future energy code compliance studies efficiently and effectively. As compliance studies become more prevalent at the state or utility level, the process to conduct compliance studies and recruit participation are critical to performing more studies economically. This report provides a better understanding of the interaction between the energy code compliance assessor and the entities controlling the building during the construction phase.

Compliance studies have been performed in Colorado since the early 2010s when the largest utility in the state, Xcel Energy, funded a study to verify compliance with the energy code. During the Xcel study recruitment, strategies started to conceptualize successful ways to obtain building department and building developer approval to access buildings and perform a compliance study. The Colorado Energy Office (CEO) funded a commercial compliance study based on the recommendation from the Colorado Energy Code Collaborative. This supported the state's desire to better understand compliance and to demonstrate to DOE its compliance with ARRA requirements.

Since 2009, Colorado Code Consulting (CCC) has been the primary organization providing compliance studies in Colorado and other western states. Because of CCC's experience with energy code compliance work, SWEEP contracted with CCC to describe successful practices to conduct future compliance studies, reduce acquisition time for building departments and building owner/developers, and report on the findings from these studies.



Gaining Building Department Participation

The code official is typically the first person to approach and discuss the concept to gain access to buildings. They have the permitting data that includes the address and occupancy type for a building, as well as the contractor, designer and the stage at which a building might be in construction. Targeting code officials should always be the first approach—they have the most information to offer the assessor.

Of the many energy code compliance studies performed since 2009 it appears that more recent efforts have improved the success rate of participation—though some have still stumbled through the relationship with building departments. As newer energy codes are adopted, building officials are becoming more familiar with the energy code, even if only at a high level. This helps with building department participation. We've found when the current energy code has been in place for a number of code cycles, many building officials are inviting researchers to review new construction and help them understand where the community needs improvement on energy code practices.

Time is important to the building official and the department. If the department is understaffed and over extended with high levels of construction, they will be challenged to participate even if they are interested in learning and improving practices. If the building officials believe the assessor will require extensive time, they will likely pass on this opportunity. The assessor must have a plan in place, and a high-level presentation of this plan/approach must be presented to the building official to understand the level of staff time required and needs for the assessor to perform plan reviews. Some may require support from their managers and city council to participate in the research.


In addition to the time required to help with the study itself, some code officials assume that any findings will create more work for them either by way of needing to implement a different practice than they are currently undertaking or by adding more work to their already busy load.

Another concern for code officials is how and where the research information will be distributed. The building official wants assurance that the information gained will remain confidential and anonymous. They don't want other communities to know their faults and they don't want the Department of Energy, the city council, or even their community to know the details of their department practices both good and not-good. Many are satisfied with the information being furnished to others, with assurances the data is anonymous. The building officials become at ease when they understand the information is anonymized and does not point to their jurisdiction or any specific building.

Assessors should be prepared to address the mistaken perception the energy code is not a life-safety code. As a result, they move the energy code to the bottom of their priorities. The assessor may have an occasion to brainstorming further education and training opportunities for the building department.



It will help to emphasize the process is specifically for research. In communicating this to building departments, we emphasize the benefits that will return to their department. We have shared compliance tools and checklists, types of building industry training, how sections of the code receive the most interpretations, and if future code change proposals should better clarify those sections. One key point is to emphasize this is not the government imposing more requirements and that no one will criticize how well they are enforcing the code. In summary, while there are roadblocks and ample concerns, they can be overcome if addressed and corrected up front.



Quick Compliance Reviews

It is important to learn the key players in the building department, and their current practices (as well as previous practices if recently changed). Conducting a quick compliance review with the building department is a good way to understand the department's staff, policies, procedures, code knowledge, and needs. This can inform the context of the study as well as build trust to gain building access.

When pertinent questions are asked, assessors can gain valuable insight into what takes place through permitting, plan review, inspections, adoption, and enforcement. In many instances, we found the city staff were not adequately versed in the requirements of the energy code and were limited in their ability to provide interpretations that align with the energy code requirements. This is valuable information for compliance and future training efforts.

These reviews are intended to be quick—in many cases only a partial day in a building department and in the field. Some time spent speaking with the developer/builder on-site is also valuable. These reviews are best done in person. Building inspection staff will have challenges participating in face-to-face meetings because of their need to be in the field. A short questionnaire can be provided in order to understand their knowledge, needs, and concerns.

At a minimum, the assessor may want to determine the following:

- What codes are adopted?
- What are the amendments?
- Who are the key stakeholders for code adoption recommendations and adoption?
- How often are new codes adopted?
- What is the adoption process—public or private?
- Is there an energy code champion on staff?
- What are their biggest concerns with the code? What do they feel they are doing correctly? Where do they need training?
- What resources and tools do they use to help with their job?
- What resources do they provide to their applicants?
- Do they have policies to address specific energy code issues that have been identified?

The appendix contains an example questionnaire that can be used to gather information for conducting data collection and analysis, as well as making recommendations for future training and resources.



Engaging Other Stakeholders in Recruitment

Because of the number of compliance studies CCC has conducted since the early part of the decade, we have a good sense of other key stakeholders who should be targeted for support in building recruitment. Here we address the key stakeholders and their primary concerns and motivations in participating.

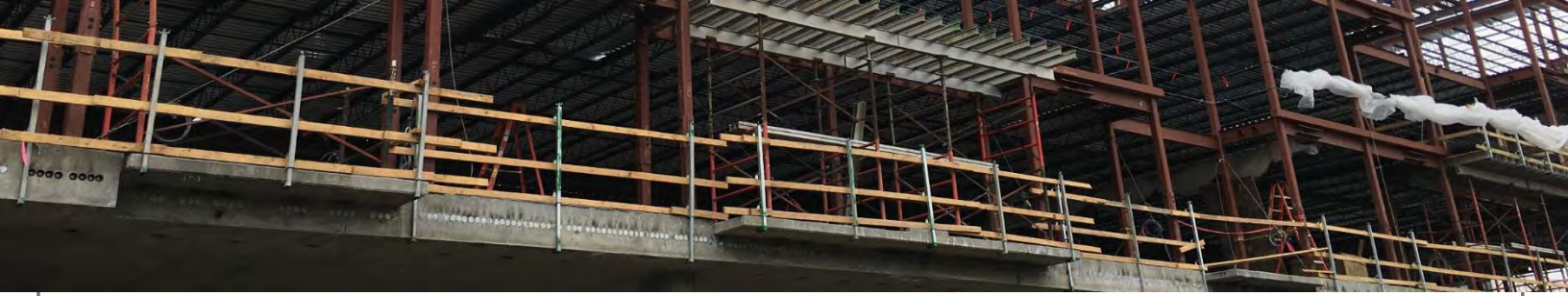
Contractors

Like code officials, contractors (the builder) are concerned about being judged. They also do not understand the amount of time an assessor will be on-site or the amount of time they may have to address questions. They are also concerned about the outcome of the research. Will it cause a delay to their schedule, more costs, or require more work during construction?

Assessors should understand there is usually not adequate communication between the different subcontractors – which leads to little understanding over what contractors are working on specific areas of the building at a given time. A master schedule is always used, but when construction occurs it becomes, at times, orchestrated chaos. This adds to the apprehension of having another person on-site to discover components, installations, and practices that are not per code requirements. On the other hand, if the contractor is approached by the assessor as if there to learn from them and asks the contractor to show the “cool things that they are doing” for energy efficiency measures, they are much more willing to allow the assessor on-site and provide a brief tour of the building. The assessor typically will receive one of two answers and may need to be prepared with a quick response for the unfavorable reply. The assessor may receive a response such as “oh no, not another person to show around” or “let me show you what we are doing and what I know.” The approach is critical and the more open and friendly the assessor presents him or herself the higher probability of success.

Most contractors will not agree to participate if they are contacted in advance. Email and phone calls directly from the assessor are typically ignored. A different response is received if the building department calls and informs the contractor someone is performing research and will just be walking the site. We have found a high success rate when this approach is taken. The builder wants to keep a good relationship with building department inspectors. While we found this method to be successful, it depends greatly on the participation of the building department. Only the highly motivated departments will take the time to contact the builders. Many departments have good intentions, however in times of high construction activity they simply do not have time for additional tasks.

Many times contractors will agree to let the assessor on-site if the assessor shows up without notice. At this point, we simply say we are doing research on what kinds of items and practices are being designed for energy efficiency in different buildings. The contractor is typically proud of their building(s) and will let the assessor walk the site without them and view the practices employed in



the building. The assessor must be prepared for this approach and must have proper protective equipment such as hard hats, steel-toed boots, and safety glasses.

One success with obtaining contractor support for an on-site review is to have college students accompany the researcher to the job site. The student should wear a shirt with the college logo and explain to the contractor they are from the college and performing research on how buildings use energy and what types of components are being incorporated for energy conservation. We have seen nearly 100 percent success with this approach. See the section on student interns participating in recruitment.

Another practice that works is to create a simple project flyer that briefly explains the research and goals of this effort. While there is a desire to put all of the study sponsors and partners on the flyer, this may be a deterrent because likely they will see a well-known entity and then think the research will be shared with all names on the list. Keeping the flyer short with only two or three pictures of common energy practices and minimal narrative is best. Think of an infographic as a concept to share. If the contractor is only presented pictures of simple building practices, they can envision their similar practice and are much more comfortable having the assessor walk the building. Don't put complex systems or assemblies on a flyer—it will be intimidating to the contractor.

Sometimes a few minutes of education with the contractor while walking a site goes a very long way. Offering a brief informal training is appropriate, but it shouldn't be done while on-site otherwise they may think the assessor is offering the training because of incorrect construction practices. Offering training to a group of contractors on what the research has found is a better way to obtain contractor support.

If a student intern, or someone who isn't completely familiar with the energy code, is gathering data in the field and interacts with the contractor, they must have business cards of key team members or key stakeholders. These individuals can answer code or building science questions instead of having the student intern answer these types of questions.

Designers

Designers, architects, and engineers, have been contacted in the recruitment of buildings, but are not usually the first contact. This is because designers aren't typically at the construction site and aren't as familiar with the logistics and construction phase of the project nor do they have a grasp of all the on-site contacts and the procedures to visit the site.

In some cases, the designer is also the contractor, or a partner with the contractor, which makes them a key stakeholder with reaching the contractor and gaining access to the site. The designer is a good resource for questions when reviewing building plans or when on-site reviewing construction because of their knowledge of the building design.



The designer may or may not be fluent in the building codes and more specifically the energy code. Much of the training the designer receives is after their schooling when interacting with building departments and as an example when their building plans are denied. There is an opportunity to offer a quick 10-minute informal training on the specifics of the energy code.

In any case, when approaching a designer it's important to recognize they are a licensed professional who typically has years of new construction experience although they may need a brief overview of the energy code or standard.

Commissioning Agents

Approaching this industry is usually successful, if you can obtain the name of the commissioning agency. Some studies have included the use of commissioning agents in building recruitment. The commissioning agent often has a list of buildings they are under contract for the design and commissioning. These professionals are happy to show the performance of the buildings and explain how these buildings are being extensively reviewed. This makes the commissioning agent a good source for accessing buildings.

Commissioning agents have also been used in studies to provide modeling and analysis of results because they have the knowledge of energy modeling software. Commissioning agents will typically agree to perform data collection as they are already at job sites and are usually more willing to have the assessor accompany them on-site. We have found on many occasions the commissioning agent is so interested in the findings of the study they are a great source for accessing buildings.

Energy Raters

Energy raters have taken part in many CCC studies by aiding with recruitment, data collection, and analysis. Raters have lists of homes they are actively involved with, as well as past projects and future projects. Assessors can accompany a rater onto the jobsite, mostly for residential studies, to gather data or they can use the rater's already-collected data to supplement their own.

Raters have occasionally helped with completing the data collection by performing the work, as the rater is already on-site numerous times during the construction phase. With the rater's extensive homebuilder contacts and project time on-site an assessor can accompany them to the house.

Energy raters can be found through the RESNET website, state energy offices, regional energy efficiency organizations, efficiency trade associations, and the local homebuilders' association.

Retired Code Officials

Retired code officials have proven to be a tremendous resource in building recruitment. They have been in the building code industry for years and have a strong network of code officials in their



state. Many are past officers of ICC chapters and are very aware of what is happening at the state and local level, which provides them with extensive insight to offer.

The retired building official can perform the up-front introductions of code officials to data collection teams. They can also explain the project to other officials in terms familiar to building department staff. The retired code official can also recruit buildings from each jurisdiction and provide data to the collection team, who then follows up and accesses the buildings. There is even an opportunity for the retired official to review plans or collect data in the field as part of the team.

When assembling a review team don't overlook the benefit of finding a retired building code official who can speak the language of the building department, have a lower billing rate than other professionals, and occasionally can volunteer their time as it brings them back into building departments.

Student Interns

College students can be leveraged to save costs in compliance studies in many ways. They can work on the contract for work-study, which can provide the intern with school credit and the school usually pays the student for this educational opportunity. Schools provide the insurance and have provided school vehicles and other resources to students.

Many of the architectural or construction management students desire to gain additional experience outside of "swinging a hammer or drawing plans." They are eager to learn and are typically interested with performing some of the behind the scenes leg work such as data entry, creating tracking tools, researching building permit data, creating flyers, and maintaining data sheets, and so-forth.

Some things to consider when using students: They cannot work full time during the school year, which means they cannot be scheduled to work a full time schedule during their school year. Students usually need a summer job and can work full time during the summer. If planning on using student interns you must plan budgets accordingly. During the school year, students typically only have a two-to-three hour window one or two days per week. The summer months allow the student full days in the field and even travel overnight if needed to collect data outside of metropolitan areas near the college campus.

Students don't often come to a project with any type of code training. When leveraging student interns the first few days should be educational on building science and energy codes before they receive training on the process of data collection, plan review, data entry, and so-forth. At first, much of data collection items won't make sense and the student will have more buy-in on the project when they have some level of understanding of the code.



The students must accompany a seasoned data collection professional when learning plan review and inspections. Eventually the student can be sent out unaccompanied to collect data with a project team member checking their work and answering questions. The first few months of training feels as though it costs more in time and resources, but after this period the student catches on quickly and can do much of the work themselves, leaving the higher paid professionals to do the analysis of results and reporting. This strategy saves project funds as long as the same students can participate throughout the project.

When performing longer-duration studies the students will return multiple semesters if they can be assured the project work is more than data entry. In the 21st century students need to be more engaged in the project and take ownership so they feel they are making a difference. Student interns who work full time during the summer months will accomplish more for the project if they feel like they have earned their wings and can do some of the work solo. Returning students can help with the training of new student interns. Providing praise and a small wage increase inspires the student and if the project is large and a long duration they typically will take the role of lead intern.



Boosting Recruitment and Engagement

Besides the main concerns and motivations described above, CCC has found additional strategies to help designers, raters, commissioning agents, and building departments provide willing assistance.

Boosting Industry Engagement

Providing free training for local chapters of the American Institute of Architects (AIA), local homebuilder association (HBA), or ICC delivers the opportunity to spread information to industry about the project. These trainings should be short and concise, similar to a lunch-and-learn.

When reaching these industry groups it is important to assure them the research is completely confidential and the data is sanitized of any addresses and contact information. If pressed for details it is best to provide only the region where the data was collected, and never the city or address.

Find people who volunteer time in the building code space such as an ICC chapter president, board member, active local code official, or retired code officials that stakeholders in the region may trust to help publicize the project and help recruit participants. When a participant volunteers they are often very passionate about the code compliance of buildings. Acknowledge their efforts with a simple gift card or some other way to recognize their assistance.

It's easier to use people for recruitment who are familiar with the codes, building inspection, plan review, and with the policies and procedures of building departments.

Include builders, designers, commissioning agents, and energy raters who are involved in the project by having them reach out to the building officials about the project and goals. Ask their thoughts and concerns with the code and with how the building department works through the compliance process. This recognizes these industry concerns and questions about the compliance research project.

It is important to remember the compliance study assessor is not a building inspector, and they should provide an accurate picture of their role at the beginning of the first conversation. The study team doesn't want the builder thinking an inspection was passed when the city hasn't performed an inspection. It's also essential the builder does not think they failed an inspection. The assessor must re-emphasize this project is research focused and this effort is completely separate from the building department.

Boosting Building Department Engagement

Building departments are short staffed, have extensive workloads, and have insufficient time to participate in a study. This is especially true if the department staff does not see the benefit for themselves or department to participate. Some helpful tools to obtain better involvement include



offering free code training with continuing education credits (CEU), or offering adoption assistance (after participating in the study the assessor will understand the needs of the building department).

Again, it's important to emphasize the project is research and not a judgement or grading of the building department. This approach gains their support more than many other approach. Share the intent of the research and observations to understand what assistance might be provided to the community through training, checklists, and assistance.

Many code officials think the energy code is complex. It becomes the assessor's responsibility to convey that the study will show where the most significant interpretation issues are occurring. This includes items missed, and items that are difficult to inspect. The research provides insight to understand where changes in the department can be made, if the code official is willing.

Offer blower door tests to demonstration where buildings currently stand with air leakage. These tests often show that builders are already doing a performing better with this test than they may have thought. Include the building code official when in the field to witness the tests. Follow up with a short building science training including the affects of air leakage, moisture, and thermal exposure which provides them with the why's of the code and its current format.


Because tools such as COMcheck and REScheck are available for at least three code cycles CCC has found the compliance study could easily be performed in any of the different code editions. This allows a jurisdiction on an older code to participate in the study. If the jurisdiction is on an older code such as the 2009 IECC, the study can be performed and evaluated to the 2009 as well as later codes showing the builder or building department how the building aligns and complies with a newer energy code.

Offer resources to support the building department tasks such as DOE checklists and plan submittal guidelines. Provide a template for an implementation plan in the event the building official doesn't know where to begin with enforcement. The building official will greatly appreciate this tool. Share with the building official your goals include making their job easier than current practices.

Don't over complicate the process and keep it simple.

Don't announce who is sponsoring or paying for the study unless asked. Saying the study is funded by DOE, a utility provider, or some other governmental agency may sway the building official away from participating in the research. Building officials are more accepting when a student, a local ICC chapter member, or an active code official participate in the research.

Lastly, be cautious on what is said to the building official. CCC suggests not informing the building official if something doesn't comply with the energy code unless it is life-safety. In the past, this has caused the contractor or building department to be concerned that more non-compliance items may be found. This can cause loss of access to buildings and plans. It's a fine line, but we suggest only revealing a life-safety issue.



Compliance Study Team

Truly valid compliance studies have been completed with small amounts of funding at state and local levels. Leverage team members who are familiar with construction and code adoption in their state or region and are already involved at some level in building codes on a day-to-day basis. If the study team must bring someone from another state, the team must include local resources who know the local landscape and are present more than out of state resources. Does the team know the right people? Do they already have a network built in the area? Do they have a list of lessons learned, roadblocks or successes? While it might be thought beneficial to have a large team, the work is completed more effectively and efficiently if the team is cohesive and tight. They can leverage the experiences from each other and previous studies. Funding maybe saved which can be used to provide assistance to the building departments and contractors, and to create tools for use on the construction project.

Team members should be trained to perform a process the same and complete the forms as similar as possible, providing consistency. Forms and presentations to building officials or building owners/developers must be simple and engaging.

The study team must have regular check-in calls, reporting, tracking spreadsheets, and possibly software applications to help with a smooth flow for the project. A list of key contacts, subject matter experts, and industry stakeholders for the code is valuable. Team members should have access to this information quickly, allowing them to provide answers to builders' and building officials' questions the assessor cannot answer. This supports a quick follow-up response and the list can be provided to the building official for future code questions. Building the team's network, as well as the building department/builders network, is invaluable. It's another resource for all to use including when the project is complete.

The study team must have buy-in and the same goals. This provides consistency with contacting, questions, interpretations and the perception the assessor is an expert for the compliance study. If one team member provides a response one way to a jurisdiction and another team member provides something contrary, this can make the project team look less credible.

Have one key contact on the team for questions, for concerns, and to make decisions when a controversy arises.

If expenses exceed budget and team members cannot provide services and education requested to the building department the team can be virtually expanded with no-cost resources such as trade associations, manufacturers, and industry experts.

Utility companies can further the virtual team as they sometimes fund code training, adoption assistance or provide codebooks. Regional or state energy offices often have funding for energy



code support. Local ICC, AIA, and HBA chapters also may fund trainings or codebooks, which can be an important resource of a team member.

All team members must be educated with understanding the important role they have during the study as they can offer a building department, builder, or designer insight into the code. The team members are leaders and experts to all stakeholders participating in the study. They have the ability to enlighten a stakeholder in a way where the stakeholder becomes the champion of the code going forward.



Appendix: Compliance Snapshot Questionnaire

2017/2018 Compliance Snapshots

Sponsored by Xcel Energy and Performed by Colorado Code Consulting

1. How well do you feel your front counter is doing at giving and receiving information?
 - a. Do you have submittal guidelines?
2. Who answers code questions?
 - a. Do you have any staff who answer most if not all energy code questions?
3. Do you feel that it is your job to educate people on the other side of the counter or that they should come to you prepared with the knowledge to get their permit?
4. Do you have concerns or ways you feel your front counter could be more efficient?
5. Do you feel you have any training needs or specific areas you would like help?
6. Are there any resources you need to better assist you with your job? Your work with the energy code?
7. In your own words, how would you describe the job responsibilities of a plan reviewer?
8. What is your plan review process?
 - a. Who reviews commercial
 - Building
 - M/P
 - Energy
 - Fire
 - Civil
 - Structural
 - Electrical
 - b. Who reviews residential
 - Building
 - M/P
 - Energy
 - Civil
 - Electrical

9. Do submitted plans contain energy code provisions as required in all IECC versions? If so, is there a pattern of missing requirements for the energy or other codes?
10. How well do you feel the plan review process is working?
11. Do you have ideas of how you could make plan review process easier or more efficient?
12. In your own words, how would you describe the job responsibilities of an inspector?
13. What is your inspection process?
 - a. Who inspects commercial
 - Building
 - M/P
 - Energy
 - Fire
 - Civil
 - Structural
 - Electrical
 - b. Who inspects residential
 - Building
 - M/P
 - Energy
 - Civil
 - Electrical
14. How well do you feel the inspection process is working?
15. Do you feel your inspectors are courteous and professional?
16. Do you have ideas of how you could make the inspection process easier or more efficient?
17. If you have an inspection line, is it working, or does it make the process harder or less personable?
18. Do you report residential building construction activity to the U.S census? (There are some municipalities that do not report and don't show in the U.S. census data)
19. Do you need help speaking with staff or City Council about any code adoptions or amendments?