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C-TRAC
Meeting # 8
Topic: Daylighting, Commissioning, and O&M
Wednesday September 1, 2010, 3 – 5:30 pm

PARTICIPANTS IN ATTENDANCE

Utilities Green Building Team

Amanda Sutton – Green Building Program Coordinator
Felix Lee – Green Building Code Project Manager
Gary Schroeder – Energy Services Engineer – Commercial GB Code Review

Facilitator

Susanne Durkin-Schindler

Subject Matter Experts

Trey King - Commissioning Agent
Eric Harrington - Daylighting Design Specialist

C-TRAC Members

Company	Representative
Aller Lingle Massey Architects PC	Brad Massey
Beaudin-Ganze Consulting Engineers	Corey Rhodes
BHA Design	Angela Milewski
Dohn Construction	Doug Dohn
Institute for the Built Environment	Josie Plaut
Greg D. Fisher, Architect	Greg Fisher
Trane / IFMA	Matt Horner
Architecture West	Steve Steinbicker
PSD	Pete Hall
Bella Energy	Rick Coen

Building Officials

Jurisdiction	Representative
City of Longmont	Chris Allison
City of Fort Collins	Russell Hovland

Key Points:

Commissioning - Gary Schroeder

Commissioning (Cx) is covered in both ASHRAE and the IgCC. Currently, the Fort Collins building code requires that building mechanical systems go through a test and balance process. That process is different from Cx in several ways. Test and balance contractors work on air and water systems, measuring the quantities of air flow or water flow and setting them to where they should be. They are not as concerned with whether or not the equipment is performing optimally or the seasonal scheduling and controls of the equipment.

Cx is much more in depth and usually starts at the beginning of the project. The Cx agent will work with the design team at the beginning of a project and assist with equipment selection and system design. They will also help hire the best contractors for the job and oversee the installation and testing of the mechanical system and equipment. They will also oversee the test and balance agent and make sure that what is being put into the report is what is actually happening. The systems are tested and optimized to make sure that every control point is operating the way that it is supposed to. All of the efforts of the Cx agent are documented and put into an owner's manual and given to the building owner.

The Cx agent is also involved in owner training to make sure that the operations staff can take care of each piece of equipment. Lastly, follow up seasonal checks are done on the equipment to make sure it is operating the way that it should during each season. The agent can also come back and perform a warranty check to troubleshoot problems and make sure the equipment is still operating the way it should before the 1 year warranty expires. Cx can cover several different systems in a building depending on the project's needs.

LEED NC offers points for both fundamental Cx and enhanced Cx. Fundamental Cx is where the systems are checked and optimized after they have been installed. Enhanced Cx has the full Cx process that was previously described. ASHRAE requirements are very similar to those in LEED.

Staff would like feedback from the committee on whether or not it makes sense to require Cx in the green building code and at what level.

Committee Comments:

- Size requirements should be a part of the code. It may be more difficult for smaller projects to absorb the costs of Cx.

- Cx is more effective if the Cx agent is involved from the beginning of the project before the designs are finished. It also helps improve efficiency by reducing punch lists, change orders, ambiguous or conflicting specs and drawings.

- A rule of thumb for the cost for Cx is 1-1.5% of the mechanical budget for the project. That could change depending on the complexity of the project. About 80% of the cost is related to what would be Fundamental Cx in LEED. Smaller projects are usually priced based on time. The design review and owner manual are some of the most valuable parts of Cx.

- Some retro-Cx projects have experienced a payback of as little as one year due to energy savings.

- It may be difficult to commission core and shell buildings because the tenant finishes are not complete. You can only take Cx so far in those situations.

- LEED allows Cx to be done in-house up to 50,000 sq. ft.

- Third party verification is an important part of the process.

- Another cost to the builder is the time that it takes for Cx. If that is required before the C.O. is issued it is going to be very difficult. Also, Cx does not end when the building is occupied.

- This requirement could apply to new construction as well as major remodels where spaces are changed and equipment is replaced.

- Cx is difficult to mandate and may be better as an option for an education and incentive program.

- The building envelope is also important and should be commissioned.

- The owner is really paying for this either way. They are either paying too much in energy bills and thermal comfort issues by not having the system commissioned or they are paying a professional to commission the building.

- 5,000 sq. ft. may not be the best cutoff point because Cx will not have as many impacts at that level. Larger buildings tend to have more complex systems and more room for improvement. Could have a less involved, cheaper option for smaller projects. LEED set their third party Cx requirement at 50,000 sq.ft. Possibly fewer requirements for smaller buildings would make sense.

- Occupancy will make a difference. Should a storage facility be commissioned the same as a school or hospital?

- For a 5,000 sq. ft. building the utility cost is probably around $1.50 per sq. ft. per year which is $7,500 per year. If Cx saves about 20% of the energy use per year the owner would save about $1,500 in utility bills per year. The Cx will probably cost around $15,000 which means the payback for this scenario would be about ten years. Five thousand square feet seems a little low for the cut off for requiring Cx.

- Modeling may be a better way to optimize the building to save energy based on the usage instead of the square footage. If the owners and designers model the building and usage and then pick equipment based on that it would help ensure that the right equipment and system are installed.

- What are the consequences for a building or equipment that does not operate the way that it should? The owner is usually the one who is working directly with the engineers and architects to design the building. If it doesn't work the owner could sue the contractor or engineer to fix it which is expensive and time consuming.

- The lifetime of a building should be over 100 years. If a building is not working correctly that can add up to huge costs.

- The owner's manual that is provided from Cx can assist the building owner and maintenance staff with future equipment replacements and help them re-optimize their systems.

- What are the low hanging fruits that could be required for smaller buildings in place of Cx? The larger commercial buildings would have to meet a performance path or commission the building.

- Issues exist around the timing of Cx and the C.O. related to core and shell buildings, timing with training and the O&M manual, and post-occupancy verification. Possible solutions to how the building department would handle this – holding money in escrow or issuing a Temporary C.O. (T.C.O.). Each of these options has its problems. Additionally, there is the potential for the Cx Agent to hold the project hostage by delaying Cx work and/or the report.

- A huge part of this is owner education. The City could require that builders/owners give a rating of how much energy the building uses per sq.ft. It could become a voluntary push from consumers who are demanding more efficient buildings and tenant spaces.

- A lot of the buildings in Fort Collins are core and shell, tenant occupied buildings where the tenants don't really understand what is going on with

the equipment and the owner's don't really care because the tenant is paying the utility bills. This should be one of the highest targets for the education component of the code.

- Bare bones core and shell Cx would involve working on the major equipment in the building. It would decrease the costs of Cx because the performance aspect of the equipment could not be tested at that time.

- A building owner could commission the core and shell of a building and focus on the basics of the system and then go back to balance the system after tenants have moved into the space.

- Four main parts of Cx. Plan review, testing, training and manual, and post occupancy verification. Could one aspect of the process be required that will make a difference?

- How would the Cx agent be qualified? What kinds of certifications are there?
    - Some certifications exist, but experience is really valuable especially for larger, more complex projects. Many large projects will interview several Cx agents and choose the one that will meet their requirements and then talk about cost later.

- The only way that the building department is going to be able to verify the qualifications of the Cx agent is through a certification or City licensing.

- It is hard for builders to sell Cx to clients because they assume that the mechanical engineer is going to design and install the system correctly.

- The Cx Agents often work for the owner not the builder. It makes it difficult to codify because it does not sit solely on the builder. Additionally, it may be a conflict of interest for the Cx Agent to work directly for the builder.

- Cx is a snap shot in time. It takes commitment on the part of the owner to keep the building operating the way that it should.

- The State of Utah is requiring envelope Cx on all state projects. They are testing the envelope as construction is going along. A company is brought in to test certain components of the envelope. These tests are much cheaper and easier to run than tests of a completed building. Errors and problems are caught earlier and are cheaper to fix.

- In past meetings the committee said that building envelope is important but now there are some members saying that it should not be tested. That doesn't seem to make sense.

The committee agrees that Cx is a good idea and should be included in the code at some level. Post-occupancy verification would be difficult to codify and administer. Staff will keep working on cost and benefit analysis to determine what that level should be. Education will be a big part of this proposal.

Daylighting - Gary Schroeder

The IgCC, ASHRAE 189.1, and LEED all have both prescriptive and performance requirements that address daylighting. All of these standards have a prescriptive option that uses some aspect of window area multiplied by Visible Transmittance of the glazing relative to a Daylighting Area, which is a multiple of the floor-to-window-head height into the building. Additionally there is language about glare control to get to a useful amount of daylight without overheating the building. The performance requirements require modeling of the design. The codes and LEED vary with the minimum percentage daylighting requirement.

Committee Comments:

- It is easy to follow a prescriptive path and still have poor daylighting.
- Many standards base their prescriptive paths on cloudy day, poor lighting conditions. In Fort Collins, there are more sunny days than cloudy ones so the daylighting is already going to be better than those scenarios.
- A prescriptive path offers guidelines for daylighting, but it is still a science that needs to be done by a designer.
- Are there certain buildings where daylighting could be applied in a way that is easier to implement (Ex. Big box stores like Wal-Mart and King Soopers)?
- Top lighting is going to be easier to control because you can add diffusers to control light.
- A lot of big box retailers are installing these systems because there is a quick payback and it makes the lighting more comfortable for customers.
- This would be difficult to enforce because the plan reviewers and inspectors will have to become daylighting experts themselves.

- The way that the standards are written could also limit building design by requiring daylighting at a certain percentage.

- The LEED daylighting requirements are difficult for some building types to meet. Roughly, 50% of local LEED buildings go for the daylighting credits. It may not be a good idea to mandate this across the board. Don't want to have a blanket requirement that we assume works for all.

- Sometimes the green building technologies do not always go hand in hand. It is important to see how these things relate to each other. The beauty of LEED is that you have a choice.

- Daylighting can be done with many different building types if it is included in the desired design from the beginning of the project.

- Daylighting retrofits can be expensive and difficult to design. This requirement should be for new construction only.

- The energy use for lighting in a building can be huge which also tends to compound things like HVAC loads.

- A prescriptive requirement could force some bad design. However, daylighting is an important component of green building. It may be better to start this requirement in the simplest form possible and then start increasing the requirement as architects, owners, and builders become more educated.

- Top lighting requirements for wide open spaces is a low-hanging fruit option for prescriptive application of this section.

- It is important to remember that top lighting can create other problems with heat gain, glare, fire rating, leakage, etc.

- 3.6% glazing to floor area ratio on acrylic double domed skylights was found to be the best ratio where enough light is let in but the heat gain is minimal.

- The integrated design approach will not work for all stores that come into Fort Collins.

- May need to be exceptions in the code. Fire rated buildings, buildings with renewable energy, etc.

A majority of the committee supports top lighting being included in the green building code but do not support a more comprehensive daylighting

requirement. Staff needs to do additional research on the costs and benefits and possible applications that could be included in code.

NEXT MEETING

September 15th – C-TRAC Meeting #9: Existing Buildings & Structures
3-5:30 p.m. City of Fort Collins Streets Facility