RESEARCH TOPIC ACCEPTANCE REQUEST

Title: The Impact of Commissioning on Comfort

Research Category: Indoor Air Quality, Comfort and Health

Research Classification: Basic and Applied

TC/TG Priority: 2 (TC 7.9)

Estimated Cost:

Other Interested TC/TGs: 2.1

Possible Co-funding Organizations: Maybe BOMA? DOE?

Application of Results: Handbooks Fundamentals Ch. 8, Applications Ch. 41; Guideline 1, Standard 55.

State-of-the-Art (Background):
Standard 55 specifies the combinations of indoor space environment and personal factors that will produce thermal environmental conditions acceptable to 80% or more of the occupants within a space. Building codes do not typically require compliance with Standard 55, but it forms a component of the standard of care for HVAC system design.

ASHRAE's previous research includes RP #702, a field study on thermal comfort in hot humid climates (by MacQuarie University), RP #821, a field study on thermal comfort in a cold climate (by Concordia University), and RP#921, a field study on thermal comfort in hot arid climates (by Murdoch University). Richard deDear and Gail Brager compiled and analyzed numerous studies of thermal comfort in occupied buildings, mostly office buildings, in RP #884 "Developing An Adaptive Model Of Thermal Comfort And Preference." The data available from these studies may provide a baseline from current building populations for the variation in achievement of thermal comfort conditions.

Current ASHRAE research (1257-TRP) "Indoor Environmental Effects On The Performance Of School Work By Children" is aimed at quantifying the effects of temperature, humidity, air supply rate, and supply air quality on academic performance of school children. The proposed research fits in the context of this and other efforts to quantify the benefits of designing buildings to achieve thermal comfort conditions.

Advancement to the State-of-the-Art:
Advocates of building commissioning claim that one of the benefits of the approach is improved thermal comfort in the commissioned buildings. In effect, commissioning is expected to reduce the likelihood that the HVAC systems provided in a building will fail to achieve comfort conditions in a given space. If this effect is significant, the value of the comfort improvements associated with commissioning will likely exceed the value of most of its other claimed benefits.

Because there is a lack of hard statistical evidence on the benefits of commissioning, there is a need for ASHRAE-sponsored research to provide this information. A study targeted at comfort benefits will begin to address this need, but only if the sample size is large enough to identify a

statistically significant difference between comfort in commissioned buildings and comfort in non-conditioned buildings. To reduce keep sample size smaller, the study will focus on one type of buildings, such as Class A office buildings. Sample size will be estimated based on existing data from previous studies on comfort.

Ideally, the study would define commissioning strictly in accordance with ASHRAE Guideline 1. It will include only HVAC system commissioning, not commissioning of the rest of the building. In reality, commissioning practice is a continuum. For the purposes of this study, commissioning is an independent, binary variable. Researchers will have to agree on a threshold of practice above which a building will be considered commissioned. **This threshold will have to be set appropriately so that enough buildings meet it to permit statistical analysis.** The dependent variable to be measured is the number of Standard 55 compliance errors measured during a site visit. This measurement would need to be normalized by number of zones measured.

The successful study will offer its key conclusion in the following form: "Commissioning a building to at least the described threshold of practice will reduce Standard 55 compliance errors by xx%."

Justification and Value to ASHRAE

Research is needed to show the connection between commissioning and comfort, to enhance the value of both Guideline 1 and Standard 55. This research will provide compelling evidence of the value of implementing commissioning, which will increase the number of practitioners who adopt Guideline 1. Commissioning according to the Guideline requires documented design intent documents, which are likely to include an explicit comfort requirement—an opportunity for increased use of Standard 55. ASHRAE will gain through increased sales and use of both Guideline 1 and Standard 55. Furthermore, if the link between commissioning and comfort is real, this will in turn increase the number of buildings that successfully meet their comfort objectives. If commissioning is proven to be a key strategy for achieving comfort in buildings, it may lead to a further opportunity for ASHRAE to develop a commissioning standard.

Objective

The overall objective is to gather evidence on the connection between commissioning and thermal comfort.

The following tasks will be required:

Phase 1:

- Using data from RP #702, #821, and RP#921, calculate mean and standard deviation for the key research variable: number of Standard 55 compliance errors measured in a given building at a given time (normalized by number of zones measured in a given building).
- Use the standard deviation from these previous studies to calculate the sample size expected to be needed for a successful result from this study. These previous studies involved the same confounding factors this study will face (user and operator adaptations, differences in space use, etc.) and will therefore provide a meaningful estimate of sample size.
- In consultation with the Project Monitoring Subcommittee, determine whether it is affordable to proceed with Phase 2 the project.

Phase 2:

- Agree on a level of commissioning practiced in enough buildings to permit statistical analysis.
- Identify a category of buildings from which both a sample of commissioned buildings and a control group of non-commissioned buildings can be drawn.

- Collect data on the key research variable for a sample of commissioned buildings and a control group of non-commissioned buildings
- Analyze the data and write a technical paper

Key References

ASHRAE research projects RP #702, a field study on thermal comfort in hot humid climates (by MacQuarie University), RP #821, a field study on thermal comfort in a cold climate (by Concordia University), and RP#921, a field study on thermal comfort in hot arid climates (by Murdoch University).

Richard deDear and Gail Brager, ASHRAE RP #884 "Developing An Adaptive Model Of Thermal Comfort And Preference."

ASHRAE research project (1257-TRP) "Indoor Environmental Effects On The Performance Of School Work By Children" (currently underway).

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