Discussions for the Technical Papers from the 2016 ASHRAE Winter Conference in Orlando, Florida

This is a compilation of the written questions and comments submitted to authors by attendees at the 2016 ASHRAE Winter Conference in Orlando, Florida. All authors were given the opportunity to respond.

The questions/comments and authors' responses are published with the papers in the hardbound volume of *ASHRAE Transactions*, Vol. 122, Part 1.

OR-16-001 (RP-1529)

A Simulation Approach to Determine the Insertion and Transmission Losses of Unlined and Lined Ducts

K. Ruan

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Karl Peterman, Senior Engineer, Vibro-Acoustics, Markham, ON, Canada: Can any of the difference in insertion loss between experimental measurement and FEA prediction be attributed to structure-borne flanking through the duct walls in the lab? What was done to address this noise path in either case?

David Herrin: It is possible that some of the discrepancies between the measurement and finite element prediction are due to structure-borne flanking. In the authors' opinion, it is more likely that this is due to background noise transmission through the outlet duct walls. The test duct runs through a student lab area. There were no measures taken to address this noise path in the measurement aside from making measurements during quiet times of day. In the simulation, a few studies were performed where sources were placed outside the outlet duct walls. The results were then similar to the measurement results. However, this effect is very difficult to simulate and is nearly unavoidable in experimental work.

OR-16-002 (RP-1529)

Using Simulation to Determine Elbow and Side Branch Attenuation and Duct Breakout Transmission Loss

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Karl Peterman, Senior Engineer, Vibro-Acoustics, Markham, ON, Canada: Did the work investigate the effect of gage and reinforcing methods on duct breakout? Will these be included in any updates to the Handbook?

David Herrin: Though realistic reinforcement was modeled, the work did not investigate the effect of changing the gage and reinforcement methods on duct breakout. From the work by Cummings (1985), it can be concluded that changing the reinforcement will affect breakout transmission loss at very low frequencies for ducts having rectangular cross sections. At higher frequencies, the breakout transmission loss will be governed by the mass per unit area of the duct walls and the critical frequency. Because these gage and reinforcement effects were not investigated, there are no plans for updating the ASHRAE Handbook information.

OR-16-004

A Parametric Study of Energy Efficiency Measures Used in Deep Energy Retrofits for Two Building Types and U.S. Climate Zones

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T. Agami Reddy, Professor, Arizona State University, Tempe, AZ: 1) The ECMs that were simulated were preselected and not determined by sensitivity analysis—is that correct? The ECMs would be building type and climate-dependent. Has this issue been considered?

2) Buildings within a building type will show variability in size, geometry, HVAC system type, etc. Has this type of variability been considered while performing the numerous simulations within each subcategory and climate?

3) Have ECM studies such as these, which have been conducted over several years, been validated with actual implementation and subsequent measurement and monitoring?

Michael Case and Richard Liesen: 1) The models used in the analyses were developed for standard military building types used within the U.S. DOD (Liesen et al. 2012). Parameters of the standard model were changed for different climates and building types; however, there is no guarantee that they are optimal. The authors are confident that detailed analysis and optimization on each building type and climate could produce better results. These results are intended for planning purpose and not final design. The facility models and the efficiency measures are in line with the US Army's Center of Standardization (COS). Once a project direction and amount of funding is determined, then an engineering design is performed for each facility where all options are optimally determined for that specific location and building mission.

2) Size, geometry, and general HVAC system type were kept constant as climate zone was changed, although envelope characteristics such as insulation and windows were modified as noted in the paper. The intent was to examine the effect of climate zone on performance.

3) Although the EnergyPlus whole-building simulation software has been extensively validated, the particular ECMs applied in the parametric exploration have not been implemented and monitored.

Kurt Lyles, Partner, Mechanical Concepts, Shreveport, LA: Where can I find the information of what HVAC retrofits were done in the Army Corps of Engineers modeling and how they turned out?

Case: That would be quite an extensive list across the U.S. Army. Please feel free to contact the authors with a more specific question on particular HVAC technologies.

OR-16-005

The Economic Challenges of Deep Energy Renovation—Differences, Similarities, and Possible Solutions in Northern Europe: Estonia and Denmark

Jørgen Rose, PhD **Kirsten Engelund Thomsen** **Ove Christen Mørck, PhD**
Kalle Kuusk **Targo Kalamees, PhD**

David Baylon, Principal, ECOTOPE, Seattle, WA: How do you account for distribution efficiency for your "district heating" measure for either site or source energy?

Jørgen Rose: We do not account for distribution efficiency of the district heating when we look at site energy, because this only covers the energy use at the building site. For the source energy, we would normally include distribution efficiency, but in this paper we only dealt with site energy.

OR-16-015

Implementation of an Adaptive Occupancy and Building Learning Temperature Setback Algorithm

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Meysam Razmara, Research Assistant, Mechanical Engineering—Engineering Mechanics Department, Michigan Technological University, Houghton, MI: 1) How much is the computation time for parameter estimation?

2) A good control algorithm for building systems means not only low energy consumption but also low resulting discomfort level for occupants. Authors should study/mention the discomfort level in their paper.

3) UKF and EKF methods have been previously used for state-parameter estimation for building applications in the literature (e.g., Maasoumey et al. 2014). The authors should clearly clarify the contribution/difference of their work with respect to these studies.

Maasoumey, M., M. Razmara, M. Shahbakhti, and A.S. Vincentelli. 2014. Handling model uncertainty in model predictive control for energy efficient buildings. *Energy and Buildings* 77: 377–92.

H. Burak Gunay: 1) The parameter estimation is handled inside a commercial building controller (Delta DSC-1146) with a 32 bit processor and 2 MB flash memory in real time. Meaning that—despite the analytical and computational challenges in solving state and parameter estimation problems—the computations were finished within a database scan period (2–5 Hz).

2) This paper presents the first stages of an adaptive occupancy and building learning temperature setback algorithm inside a laboratory environment (a shared office space with a stand-alone controls network). Therefore, we were able to infer the occupants' comfort through their simulated frequency of interactions with the thermostat. In the field implementation stage of the research project, we look into other metrics such as the ratio of arrivals below heating or above cooling setpoints, the occupied time spent below heating or above cooling setpoints, and the institutional complaint logs. This information will be presented in a future paper.

3) The authors are aware of the Maasoumey et al. paper (2014) and we acknowledge its contribution. In this endeavor, unlike the prior work, our emphasis is on developing practical indoor climate control strategies by incorporating occupants more actively and by acknowledging the computational, analytical, and sensing and metering-related limitations of the existing building controls networks.