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Episode 643 | October 22, 2021 | 12:00 PM EST

Robert Bean, FASHRAE

The Edifice Complex, IAQ, HVAC, Building Science & COVID

This week we welcomed back Robert Bean a retired engineering technology professional having practiced in building construction engineering technology and mechanical engineering for decades. This was both a thought provoking and entertaining interview on IAQ, HVAC, Building Science and COVID. Mr. Bean specialized in the design of indoor environments and high-performance building systems. He is an ASHRAE Fellow, third term ASHRAE Distinguished Lecturer, recipient of the Lou Flagg Award, and Distinguished Service Award. He has authored numerous papers, articles, and course curriculums and serves on several technical committees related to indoor environmental quality, building, and thermal energy systems. Robert also continues to maintain the healthyheating.com website where you can get his FREE book "Thermal Comfort Principles and Practical Applications for Residential Buildings". If that's not enough he is Co-host of the Edifice Complex Podcast which is designed to blow apart how buildings are designed, fabricated, commissioned and operated. LEARN MORE this week on IAQ Radio+.

Nuggets mined from today's interview:

It's been 12 years since you've been on IAQradio, that's 528 shows ago.

The Edifice Complex Podcast is a very clever name, what is the source? My co-host Adam Muggleton, came up with the name. Adam has worked in construction in over 30 different countries. "Architecture feeds the egos of the susceptible. They grow more and more dependent on it to the point where architecture becomes an end to itself, seducing the addicts as they build more and more on an even larger scale. Building is the means by which the egotism of the individual is expressed in

its most naked form: the Edifice Complex. Sudjic, Devan (2005) *The Edifice Complex: How the Rice and Powerful Shape the World*. New York: Penguin Press. pp.184-185. ISBN 1-59420-068-8

Retirement can provide the joy of dealing with the things we want to deal with (e.g. grandchildren, the healthyheating.com website, volunteering at ASHRAE, etc.) He misses opportunities to apply math to a design and measure success by the numbers.

Go to the healthyheating.com website and download free book "Thermal Comfort Principles and Practical Applications for Residential Buildings". The book is distributed free because it was written under a grant.

Thoroughbred Buildings are buildings which have been build to standards and consider human comfort through sound, thermal, lighting, IAQ, vibration and odors.

Building complaints are most often attributed to architecture, enclosure and/or interior design. HVAC system are only there because of the flaws in the first three.

Robert discussed a building project he was involved in Calgary, Alberta Canada. In Calgary temperatures of -40°F are common. The client like 80% of his clients were other engineers who understood technical building issues such as: thermal bridging, window to wall ratios, mean temperatures, etc. He recommended that a depressurization test be done on the building before closure. The client declined. After construction was complete condensation occurred due to leakage. A depressurization test was used to locate the problem areas. *Why do the calculations if you don't go into the field and verify them?*

Building Science Corp.'s Summer Camp is attended by 450-500 very smart people involved with building science. Less than half could name the ASHRAE thermal comfort standard, fewer more could name the 10 (now 12) metrics in the standard and less than 1.5% could do an ASHRAE 55 Compliance Test. Those stats have held true for decades and for the entire industry.

Thermal comfort complaints. Air temperature as a proxy for thermal comfort is as wrong as calling baking soda a cake. Standards call for 80%-90% occupancy satisfaction, the reality is much lower than that. Forget about air temperature being a proxy for comfort, approach the problem from the perspective of the body trying to use its skin to radiant heat cold surfaces such as glass.

There is nothing we don't know.

The four horsemen:

- Architecture, simple and appropriate
- Enclosure, reduce thermal bridging and WWR and tighten it up.
- Interior design, not decorating design! Protecting human health and safety, fire exits. Start with the exterior to get the interior right. Shortwave radiation and moisture deteriorate synthetic materials. Fix the glass (e.g. sound, light, vibration, etc.)
- Mechanical systems

Occupants are trying to avoid discomfort. Uncomfortable occupants get pissed and then use energy to get un-pissed. We look at numbers/statistics and forget the people. We are ignoring the people we are building for.

Battle of the thermostat photo shows a man in a 3 piece suit and tie and a woman in a thin sleeveless dress. People who wear less clothing are less comfortable! Look around, critical thinking has vaporized. It's not a gender issue, it's a clothing issue!

Robert had a serious prior respiratory health challenge and when he heard about the Covid virus at the 2020 ASHRAE convention he immediately ordered a supply of N95 masks. He instinctively knew that Covid spread was airborne and that Covid was transported by riding on airborne particles. "Cognitive dissonance
In the field of psychology, cognitive dissonance is the perception of contradictory information. Relevant items of information include a person's actions, feelings, ideas, beliefs, and values, and things in the environment." - Wikipedia

Zippy stuff aka HVAC gadgetry. Akin to young stupid fish chasing shiny lures. Keep it simple works. MERV 13+ filtration works and UV is proven. Research papers on bipolar ionization et al have the same conclusions today they did years ago. S&Ms (Sales and marketing claims are smoke and mirrors.)

Be careful when manufacturers launch new technology that doesn't catch on and is subsequently withdrawn from the marketplace; leaving customers stranded without technical support, maintenance and repair.

Buildings should solve thermal problems. HVAC compensates for flaws in buildings. Designing with the anticipation of failure prevents catastrophe. Boilers and electrical heating are good backups. Dependency on burning fossil fuels is stupid. We won't be heating with hydrocarbons in 100 years. The requirement is only to

heat to the temperature of the human body, using anything that burns hotter is wasteful.

Reduce heat loads with the enclosure. Use large area heat exchangers. In the future we will be talking about exergy not energy. "Exergy is the amount of work obtainable when some matter is brought to a state of thermodynamic equilibrium with the common components of the natural surroundings by means of reversible processes, involving interaction only with the above mentioned components of nature" [Szargut et al 1988]. 60% exergy in efficiency is likely achievable in our lifetime.

Best recommendations for retrofits? Control the enclosure, air seal, focus on critical areas first.

Roundup

- Raising the RH for health will take a toll on the buildings. When we have control over the enclosure we can raise the RH.
- Artifacts from other environments may be sensitive to RH when moved to a new environment (e.g. wooden carvings, guitars, etc.)
- Winnipeg, Manitoba Canada has a most challenging climate, from Alaska to Florida ranging from (-40°F to 110°F). What's out wants in and what's in wants out. The 4 horsemen [architecture, enclosure, interior design, mechanical systems]. Hybrid heating system. Radiant base load requires a radiant solution. Use air-based systems only as trim. Don't use convective solutions to solve radiant problems and vice versa.
- When Covid first struck, the CDC, WHO and other organizations around the world spread misinformation. Infectious disease and epidemiologists stuck to old dogma. Covidisairborne.org came to be because people are fed up with the wrong information. In Canada, elected officials in charge are being held accountable through crowdfunding. A tribunal in Brazil has recommended that its president be charged with crimes against humanity.
- Stay safe

Z-Man signing off

Trivia: Name both the inventor of a toy modeled after a construction method used to build the earthquake proof Imperial Hotel in Japan and the toy he invented?

Answer: John Lloyd Wright and Lincoln Logs
Answered by: Vic Cafaro