Radiant Floor Research Offers New, Hard Data

by Lawrence Drake

In 1999, Kansas State University was awarded a contract to do an ASHRAE research project endorsed by the RPA. The project included the support of equipment from several RPA member manufacturers. The purpose is to test various radiant floor structures and develop an algorithm, or mathematical procedure, for accurately predicting the performance of a wide range of radiant floors. The project's official name is: "Develop Simplified Methodology to Determine the Surface Heat Transfer Rates from Radiant Conduits." As the initiator and member of the monitoring committee, I recently visited with Professor Kirby Chapman at KSU's engineering laboratories.

Kansas State University professor, Kirby Chapman, at the controls of the radiant floor heating test chamber.

The research project is behind schedule due to construction delays and student commitments. A revised completion date was set for March 15, 2001. KSU is planning to present the final report to ASHRAE on September 1, 2001.

The good news is that the actual validation testing is complete. A recording computer is stuffed with data from dozens of sensors that were embedded in floors, walls, and ceilings, and suspended at various levels within the test chamber built specifically for the research project. The chamber was constructed with a crawl space under the floor so that radiant heating tubes could be applied in different configurations. Due to ASHRAE budget restraints, testing was limited to six configurations:

- tube suspended in the joist space
- tube stapled to the subfloor with insulation held 2" below the tube
- tubing stapled to the subfloor with insulation pushed up tight
- and the same thing repeated using aluminum plates.

The test chamber walls are cooled with chilled air ducted in the wall cavity between the wall studs. This allows the interior chamber walls to simulate 0˚ F outdoor temperatures. Two test series were conducted. One measured the heat output of the floor at a given water temperature, while the other measured the recovery time from a cold start to

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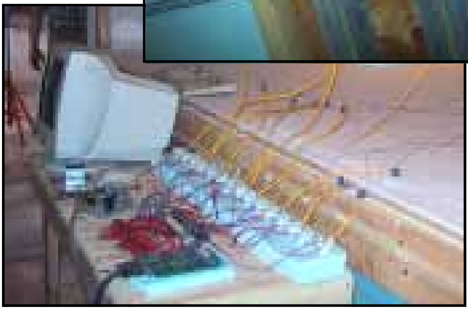

The chamber records data from thermocouples place strategically throughout the floor

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steady state. While I can't reveal results prior to official release by ASHRAE, it's clear from the data that aluminum plates make a significant difference in improving heat transfer, as does the placement of insulation in the joist space. The solid data from this study will certainly reduce the many sources of controversy about the operational efficiency of these applications.

The final outcome of the study will be a method of accurately predicting and comparing the heat transfer rates of radiant floor systems, from slab-on-grade to engineered floor panels. We also hope for the possibility of actually testing and rating various floor structures and products installed as recommended by the manufacturers. This would leverage great credibility among consumers and help to temper the claims of overzealous salespeople.

There are a few things that make the KSU test less than ideal. Because of the need for a crawl space, the floor-to-ceiling height is only about five feet. Also, board insulation was used as joist space insulation rather than the more typical fiberglass batting. This leaves an air gap the depth of the tube when the insulation is pushed up tight. Professor Chapman readily agreed that any further testing will be made with a standard ceiling height, and batt insulation.

Although time will tell, I feel that this research marks the beginning of a new chapter in the history of radiant heating systems. From here the industry will develop accountability and verification procedures. These can only improve both our image and our products. It comes at a time when we are on the edge of a "green" building movement to maximize our natural resources and create indoor environments that are healthier to live in. Radiant heating has many of the answers. All we've really needed is the hard data to support our claims. Yes, the industry is growing up! ■