THERMALLY ACTIVE BUILDING STRUCTURE

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Radiant heating has a long history at least as ancient as the Roman Baths. It takes advantage of the fact that, for low ambient air velocity, most of the heat transfer from the body's clothed surfaces takes the form of radiant interaction with surrounding surfaces. While radiant heating in buildings has long been recognized for effective comfort maintenance, radiant cooling systems, and especially, those capable of providing radiant conditioning in both heating and cooling modes are very rare, especially in humid climates. Following are benefits of radiant heating/cooling floor and ceiling systems (thermally active structures):

- Improved human comfort through reduced variation of mean radiant temperature
- Incorporation of the thermal mass of the building structure into the conditioning system
- Removal of absorbed solar heat gain directly from building mass with reduced air flow
- Reduced transport energy for water as compared with air for heat transport medium.
- Reduction of plant size for conditioning and thermal transport system.
- Significant reduction in energy consumption without compromise of comfort maintenance

Recent innovation at Flack + Kurtz, Inc., as listed below has enabled thermally active structures (radiant heaint/cooling) to overcome multiple barriers that had previously inhibited its utilization in humid climates and in climates with frequent heating/cooling changeover requirements.

- Development of control protocols for heating/cooling changeover to avoid "driving" the structure (reheating a previously cooling or re-cooling a previously heated massive element). "Driving" was a major barrier to energy efficiency.
- Development of coordinated control protocols for radiant floor and dedicated ventilation systems to insure adequate ventilation, dehumidification, comfort maintenance and avoidance of systems "fighting", along with enhanced energy efficiency.
- Development of design tools to quantify heating and cooling capacity variation in response to different design variables and in response to environmental factors such as absorbed solar heat gain and radiant interaction with exterior partitions.
- Development of system configurations and construction details to avoid condensation on thermally active surfaces.
- Development of design approaches to maximize effective cooling capacity in spite of narrow temperature ranges allowed by condensation avoidance.
- Development of design approaches that enable conditioning surfaces to respond to the complex pattern of solar heat gain and shading, achieving optimal cooling capacity without overcooling shaded areas.

Refinement of thermally active structures has been pursued for over fourteen years, addressing individual problems and issues as they have arisen on projects. The results of these efforts have been encoded in a "Design Manual for Thermally Active Structures" that has been distributed throughout the parent engineering organization. The technology, as developed, will be utilized widely in future projects. Below is a list of successful projects that have utilized this technology:

- St. Meinrad Archabbey Church, St. Meinrad, IN - first effort at radiant heating/cooling floor in a humid environment
- Virginia Hand Callaway Discovery Center, Columbus, GA – entire public area of building
- William Jefferson Clinton Presidential Library, Little Rock, AR – radiant heating/cooling system for a NARA approved document preservation and display area
- Syracuse University School of Management, Syracuse, NY - atrium and study lounge
- Dartmouth College, McLaughlin Hall and MacLane Hall, Hanover, NH – radiant heating/cooling floor and ceiling system as only temperature control system for dormitory rooms. Maclane Hall demonstrates 50% energy savings compared with code.
- Hearst Headquarters Tower Lobby, New York, NY – radiant heating/cooling for main lobby of tower with chilled fountain to avoid humidification and resultant condensation.
- Gaylord National harbor Hotel, Oxon Hill, MD – convention hotel with 60,000 sf atrium conditioned with heating/cooling floor and supplemental air system.

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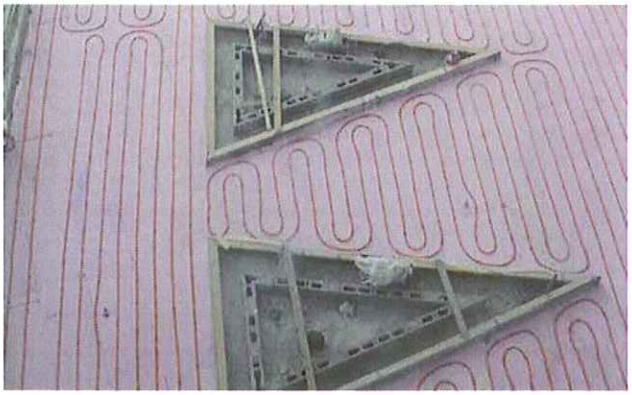
William Jefferson Clinton Presidential Library, Main Exhibit Hall, Little Rock, AR – Radiant Heating and Cooling Floor



Syracuse University School of Management, Syracuse, NY – Radiant Heating and Cooling Floor

Hearst Headquarters Lobby, New York, NY – Radiant Heating and Cooling Floor and Water Feature

Thermally Active Structure Projects