

SPRI/ORNL Study Shows Ballast and Paver Systems Save as Much as a 'Cool' Roof

SPR I, the association representing sheet membrane and component suppliers to the commercial roofing industry, has released a final report on a joint study with the Department of Energy, entitled, *Evaluating the Energy Performance of Ballasted Roof Systems*. The purpose of the study is to determine whether ballasted roofs offer similar energy efficiency benefits as "cool" roofs and are deserving of cool roof status from the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), as well as other federal and code organizations. The complete report is now available for free download from the SPRI Web site (www.spri.org).

The research team, led by André Desjarlais of the Oak Ridge National Laboratory (ORNL), conducted side-by-side experiments comparing different weightings of ballasted roofs and a paver system, along with black and white membrane controls. Each test section was a 4 ft x 4 ft area. The three gravel ballast systems weighed in at 10 lbs/ft², 16.8 lbs/ft², and 23.5 lbs/ft². The paver assembly weighed 23.5 lbs/ft² — the same as the heaviest stone-ballasted roof. There were also 4 ft x 4 ft sections for the white and black membrane controls. Data collection included continuous monitoring of temperatures, heat flows, and weather conditions, as well as periodic verification of the surface properties of solar reflectance and thermal emittance.

"After less than two years' exposure, the medium and heavy ballast, along with the

paver systems, have peak heat flows that are lower than the white membrane roof," says Desjarlais. "This suggests they are as effective as white-membrane roofs in mitigating peak energy demand. In addition, their yearly energy usage is lower than the white-membrane roof, indicating that equal total energy savings can also be obtained with roofing systems that have 'mass.'"



The Roof Thermal Research Apparatus at ORNL configured for ballasted-system analysis.

The study also found that the heaviest ballast system and the paver assembly have identical area densities but substantially different solar reflectances of 0.22 and 0.55 respectively, yet had similar thermal performance. These observations strongly suggest that the controlling parameter is mass and not solar reflectance.

By reducing peak roof temperatures and delaying heat flow into a building, the mass of a ballasted roof provides measurable energy saving benefits, according to the study. However, although these roofs show superior energy savings, they currently do not meet the official "cool roof" require-

ments of high solar reflectance. Hence, the Environmental Protection Agency and other organizations such as ASHRAE and the California Energy Commission (CEC) were approached to modify their definition of a "cool roof." The CEC has included ballasted systems as a prescriptive equivalent to a "cool roof" in the just-approved 2008 Title 24, while ASHRAE has inserted it in the revisions being made for the next version of Standard 90.1. The EPA is reviewing the request that the ballast system be included in the ENERGYSTAR® roofing category.

EDITOR'S NOTE: A report on this research, by André Desjarlais, Thomas Petrie, and William Miller, entitled, "Are Ballasted Roof Systems Cool?" was presented by Desjarlais and Petrie at the RCI 23rd International Convention in Phoenix in March 2008. Dick Gillenwater, Thomas Petrie, William Miller, and André Desjarlais presented and published an earlier paper, "Are Ballasted

Roof Systems Cool?" at the May 2005 RCI Foundation conference, "Cutting Through the Glare." That latter paper was also published in the September 2005 issue of *Interface*.