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PAVING

Infrared Cameras Reveal World of Pavement Problems

State transportation departments and private contractors have found a way to determine where a pavement mat will turn into a pothole. Their technological crystal balls are infrared cameras that photograph hot mix asphalt during the pavement laydown process. The devices look for patches of asphalt that are too cool and will not compact correctly.

For decades, transportation contractors have attributed short pavement life to aggregate segregation. But infrared images now suggest that temperature differentials within a mat can cause an overlay expected to last 15 years to fall apart in less than 12 months.

As part of a Washington State DOT study in 1998, Joe Mahoney, a University of Washington professor of civil and environmental engineering, had graduate students observe nighttime paving projects. Student Steve Read measured the temperature of HMA during the pavement process, using a household thermometer, and found that areas of the mix were under 175°F, below the necessary temperature to compact the mat properly. Because of cooler ambient temperatures at night, the increasingly common practice of paving after dark posed a threat to the construction of durable roads.

Don Brock, CEO of Chattanooga, Tenn.-based asphalt equipment contractor Astec Industries Inc., was impressed enough with the early research to lend WSDOT an infrared camera. WSDOT pavement structures engineer Kim Willoughby was one of Mahoney's students. "We were losing up to 50% of our pavement life, which is 15 years," she says. "Since 1998, we've used the infrared cameras on 70 projects. We even use the cameras in our specs now, penalizing contractors whose air void is over 7%."

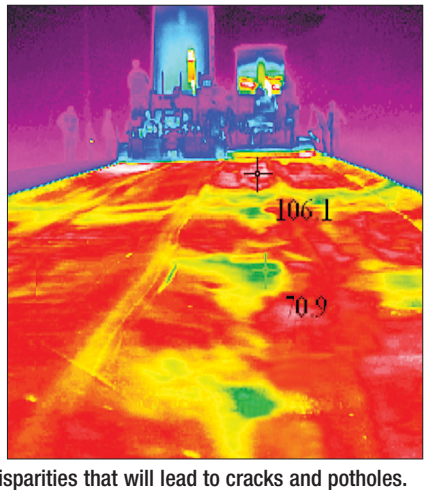
Leonard Phillips of Forward Looking Infrared Systems, North Billerica, Mass., an infrared camera manufacturer, says that every 1% increase in pavement mat air voids causes a 10% reduction in pavement life. A mat area that is 25°F cooler than the rest of the mat is associated with a 2% increase in air voids. State DOTs, including Oregon, Minnesota, Texas, California and Massachusetts, believe that difference in quality is enough to make the $15,000 to $40,000 cost of an infrared camera worthwhile for their highway projects. "It's like a blind person who goes out into the world, and sees things for the first time," says Phillips.

Cold weather conditions were a challenge for the Central Artery/Tunnel project in Boston. Matt Turo, pavement management engineer for the Massachusetts Highway Dept., used an infrared camera during January 2003. On some days the high temperature was only 22°F. "Normally we don't pave under 40°, but we had a FLIR camera on loan," Turo says. "Because we could find the temperature segregation, the mat went down with a uniform temperature, so that we'll get the full life of the pavement, 15 to 20 years." Contractors can use cameras with either an eyepiece viewfinder or an LCD screen that can feed the image to a larger monitor.

Dave Newcomb, vice president for research and technology at the National Asphalt Pavement Association in Lanham, Md., says the use of infrared cameras is still at the exploratory stage. "It's a good tool for feedback for a construction crew," he says. "It can point out where problems may come up in the future." Although many states are seeing budget deficits, Newcomb says the high cost of the cameras may still be worth it. ■

By Leah Hitchings

"It's like a blind person who...sees things for the first time."
— LEONARD PHILLIPS, FLIR



▲ **Hot Topic.** Infrared images of the pavement mat show temperature disparities that will lead to cracks and potholes.

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