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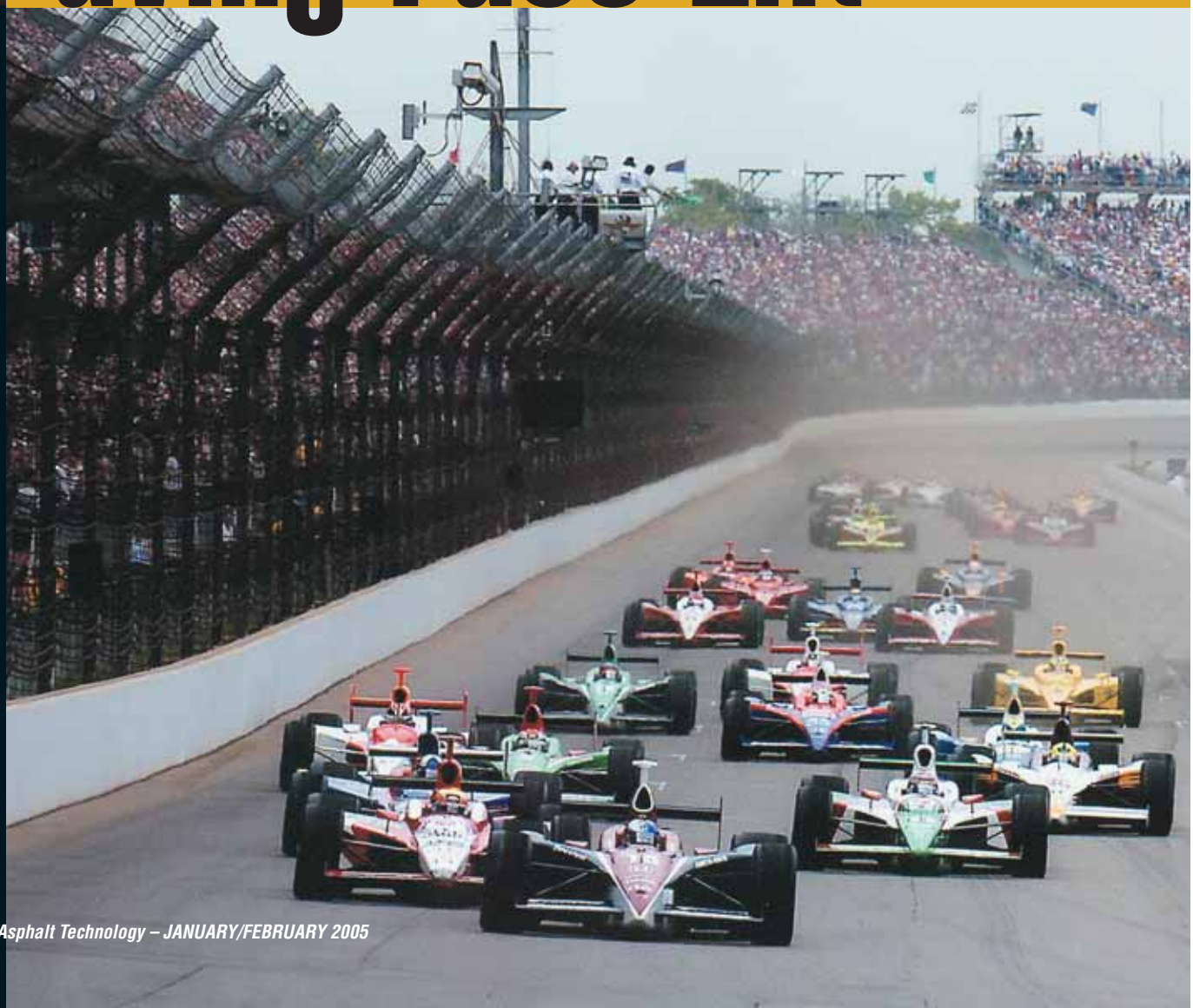
# Indianapolis Motor Speedway Gets a Paving Face Lift



IMS photos by Roger Bedwell, Bill Watson, Day Boyd, Dan Helrigel, John Cote. Additional photos by Bill Pine.

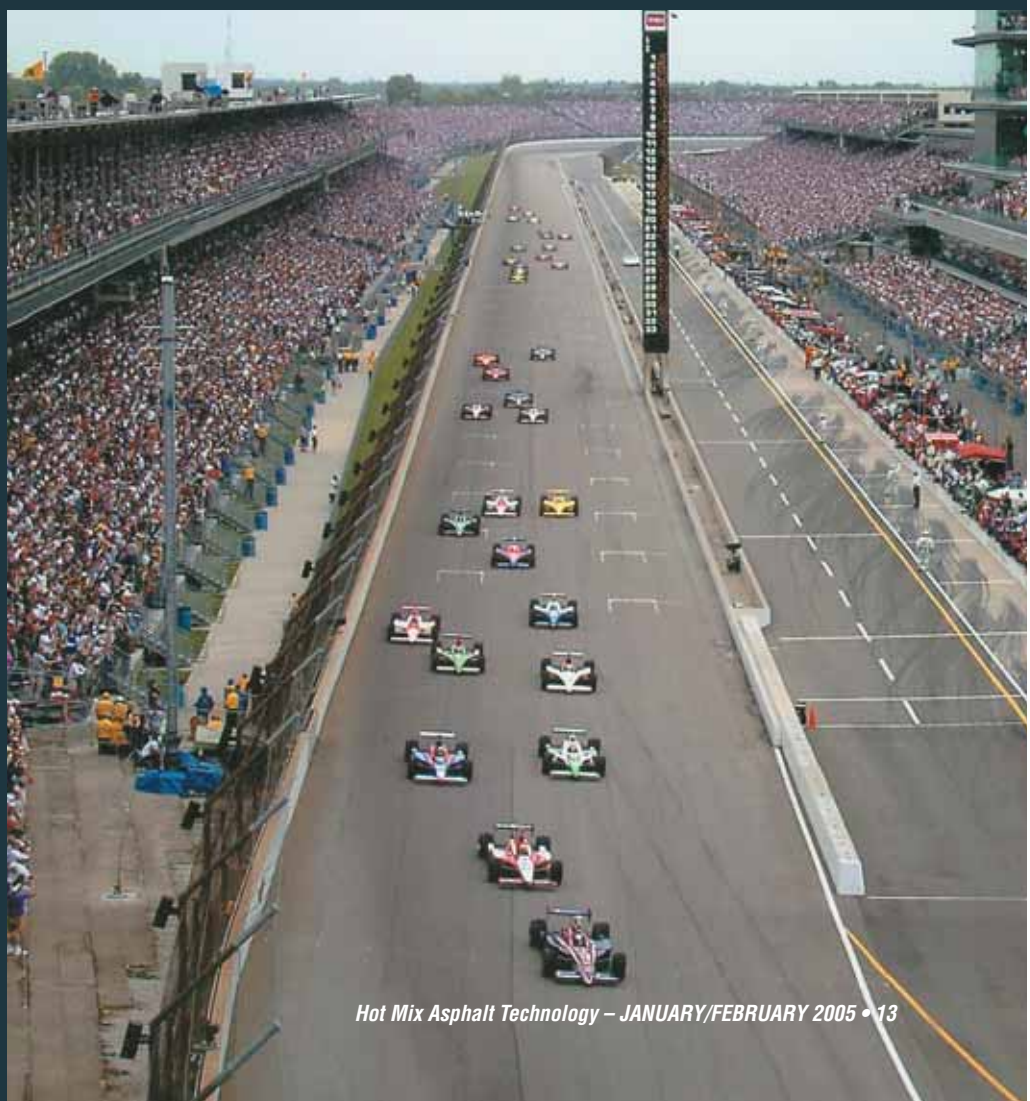
Some 350,000 people attend the Indianapolis 500 each year over Memorial Day weekend.

*By Chuck MacDonald*

The low-slung cars rocket along the track at over 200 mph as the tires grab the pavement for traction. Some 250,000 fans cheer from the stands while another 100,000+ yell in the infield. The location is America's most famous racetrack, the Indianapolis Motor Speedway (IMS).

Synonymous with car racing in the minds of many people, the IMS each year hosts the Indianapolis 500 on Memorial Day weekend, as well as the United States Grand Prix in June and the Brickyard 400 in August. Each of these events boasts the largest attendance of any single event in sports.

Because of its importance in American car racing, the Speedway gets special care at paving time. The track was repaved in 1976, 1988, 1995, and again in September 2004. For the 2004 repaving project, the mix was designed by Heritage Research Group, produced by Milestone Contractors and placed by Grady Brothers, all of Indianapolis.



Kevin Forbes, Director of Engineering and Construction at the Indianapolis Motor Speedway, examines cracks in the pavement prior to paving.

The old track suffered from surface and reflective cracking.

The existing air-cooled blast furnace (ACBF) slag surface contained a significant amount of random cracks, which were primarily "top-down" driven. In addition to decreasing the overall pavement smoothness, the cracks were allowing dirt and debris into the open graded drainage layer (OGDL) lying immediately beneath the surface. The OGDL, also placed in 1995, initially solved the age-old problem of "weepers," which develop from rainwater infiltrating the track surface (joint, cracks, etc.) in the upper lanes of the turns and slowly working its way down the slope within the pavement structure until it leaks out onto the surface in the lower lanes. Long after the sun would come out after a rainstorm, the track would continue to seep water that had collected in its structure. Since an Indianapolis 500 race cannot be run with water on the track, the huge crowd of 400,000 people sometimes waited for hours for the track to dry and the race to continue.

**Work crews laid the asphalt mat as close to the retaining wall as possible.**

**Roller operations had to be done with precision at the track.**

To fix the problem, Kevin Forbes, P.E., the track's director of engineering and construction and Bill Pine, P.E., a research engineer at Heritage Research Group, decided to make the track as impervious to water as possible. This would enable the track to dry faster and racing to resume more quickly after rain.

In addition, the new track had to be designed for strength and durability. Cars rocketing into turns at more than 200 miles per hour create horizontal shear stress that no ordinary pavement could hope to withstand for long. In addition, the cars' tremendous speed creates a need for smoothness and skid resistance.

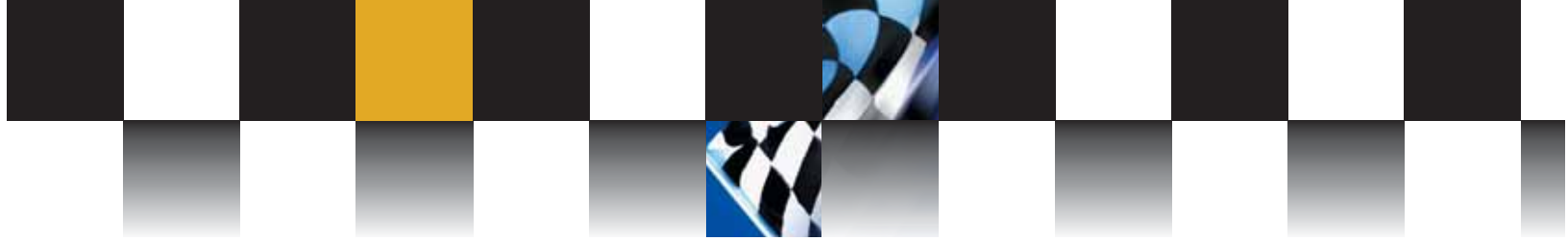
Just as drivers at the races take calculated risks, Forbes and Pine decided to take a risk on a stone matrix asphalt (SMA) mix that had not been tried before at the track. However, in their minds the real risk would have been to *not* use SMA. "We believe SMA will provide the best of both worlds—strength and durability," said Pine. "We also decided to use steel slag as the coarse aggregate in the SMA surface mix. The combination of characteristics

**The team from Grady Brothers used a consistent rolling pattern on a SMA mix to achieve at least 94 percent compaction. The crew used a consistent feed of material and a steady pace to complete one revolution of the 2.5-mile track each day. This procedure limited the number of joints in the mat.**

inherent with SMA, along with utilizing steel slag in lieu of ACBF slag to reduce the opportunity for AC absorption over time, will slow down the aging process, and improve long term durability."

SMA has other qualities that make it desirable for this track. "When done right, SMA is easier to compact than a comparable dense-graded mix," said Pine. "We felt utilizing an SMA would improve our opportunity to achieve higher than normal in-place density, especially on the banked turns, where compaction is more difficult. And the denser the mix is, the more impermeable it will be."

As with any paving job, good longitudinal joints are important. Therefore, it was decided to use additional



**"The surface must be able to resist cracking, it must be impervious to water, and it has to have great shear strength. It also must be a mix that we could get good compaction on. That's why we decided to use SMA."**

means to reinforce the joints and create a further barrier to water entering the mat at this vulnerable point. Centered under the longitudinal joints in the SMA surface, they placed an 18" wide band of a polymerized asphalt material (JBand). It is designed to melt on contact with HMA and migrate upwards, reducing the permeability along both sides of the joint. Workers also applied another Heritage Group product, Extruded Joint Bond (XJB), along the face of the unconfined surface mat, prior to placing the adjacent lane, to create additional elasticity and conformance of the joint to prevent cold weather cracking.

### *Paving considerations*

To insure only one transverse joint per lane, the paving completed a full lap around the 2.5 mile track each day. Five rollers ran behind the paver, using a consistent rolling pattern and creating densities of 94 percent and above around the track. The paving crew created four lanes around the track, which is 50 feet wide in the straightaways and 60 feet wide on the turns.

The paving project used about 19,000 tons of asphalt. After milling 2.5 inches off the old track, the paving crew laid 1.5 inches of 9.5 mm dolomite SMA leveling course. After diamond grinding some isolated locations to further increase the opportunity for achieving exceptional smoothness in the final product, the crew laid a 1-inch thick, 4.75 mm steel slag SMA surface. PG 76-28 was used in all lanes, with PG 82-22 used in high stress areas, for each of the two SMA lifts.

Milestone carried out quality control at the plant, along with density and smoothness testing at the track. In addition to non-destructive testing of the in-place product, core samples were taken in at least five different places in each lane for additional mixture analysis at Heritage Research.

Most engineering directors are concerned about quality. But few will show up for work each day at 6:30 a.m. and work until 9:30 p.m. alongside the paving crew. Kevin Forbes did that to help ensure the track was built right. He figures he walked from seven to 10 miles those days. "I didn't want to be the kind of supervisor who walked out once every couple of hours and told the crew they were doing it wrong," he said.

He quickly earned the respect of the workers. "I soon became like one of the crew. They wanted it done perfectly just as I did, so they were OK with me raising concerns and offering suggestions."

Forbes has been around construction projects his whole life, so being a quasi-member of the crew felt natural to him. So did his quest for quality on this project. "The surface must be able to resist cracking, it must be impervious to water, and it has to have great shear strength. It also must be a mix that we could get good compaction on. That's why we decided to use SMA."

# Paving is No Picnic at Indianapolis Speedway

Like all racetracks, the IMS presents some special paving problems. Each of the four turns is banked at nine degrees. "We had a material transfer vehicle one lane below the paver sending up the asphalt to insure a smooth delivery," said Tom Grady, of Grady Brothers.

In such a high-profile job, he wanted to make sure everything was performing well, from equipment to workers. "We concentrated on following good paving practices," Grady said. "We wanted to make sure there was no bumping of the paver. We kept a constant head of HMA going into the paver. And we did a complete pass of the track without stopping all day. In two sequences of four passes, we completed the track."

The paving crew also started the project with the top lane of the track so that construction traffic wouldn't be rolling over a just-completed mat.

When paving IMS, the team at Grady Brothers sought to get the track as smooth as possible. "A smoothness test is done with a profilograph, so we could find out if there was a problem and could fix it before the final lift. We wanted the final product to be mirror-smooth."

## Indy 500 Facts

**Length of track**: 2.5 miles
**Turns**: 4
**Banking at turns**: 9 degrees
**Attendance**: Averages between 350,00-400,000 for each of the three major races.
**2004 Indianapolis 500 winner**:
Buddy Rice
**2004 Brickyard 400 winner**:
Jeff Gordon
**2004 Indianapolis Formula One winner (U.S. Grand Prix)**:
Michael Schumacher

At the completion of the paving, Forbes drove the new track looking for imperfections. Rain had been falling all day, with no sign of pooling or other problems. A slight smile of satisfaction escaped him, "It's the most incredible mat I've ever seen," he said quietly.

Heritage's Pine reflected on the project and its application for more normal road-building activities. "Some 95 percent of what we do is just good paving principles that would work on any highway project," he said. "We make sure that the paver speed is right, there's consistent rolling patterns and that we make good, tight longitudinal joints. But most 'normal' highway projects aren't getting tested at 200 mph. That's what made this project especially interesting." HMAT