From pour to roar

IndyCars first to test the mettle of a new infield track at Indianapolis speedway

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Steely determination is needed to propel a car around a racetrack at the limit of adhesion, to push it through a corner always on the verge of sliding into the wall and not be distracted by thoughts about spinning off the track, into a barrier and off to the hospital.

Drivers need confidence in their car and confidence in the level of grip they can expect from the track surface.

Grip played a role in the recent repaving of the infield road course at the Indianapolis Motor Speedway. The famous speedway oval, the home of the Indianapolis 500 Mile Race, used to be paved using air-cooled blast furnace slag as the coarse aggregate. The speedway managers decided to switch to coarse aggregate made of steel slag for better grip when the oval was last paved in 2004.

The management was so happy with the way the oval worked out they decided to use steel slag as coarse aggregate in the asphalt used to repave the infield road course last fall. The road course is the racing surface that uses part of the oval but also winds around the infield.

The speedway organizers were planning for the inaugural IndyCar Indianapolis Grand Prix. They wanted to add some extra excitement to the month of May by adding a marquee event. The IndyCars raced on the road course on May 10 and stuck around for two weeks to prepare for the Indy 500 on May 25. Any disorientation the IndyCar drivers might have felt was because the Indy GP made the cars circulate clockwise, opposite to the direction they travel for the 500.

Steel slag provided both good macrotexture (with a 9.5-mm nominal maximum aggregate size [NMAS]) and good microtexture (the roughness of each face of the chunk).

Most pavements—either concrete or asphalt—use aggregate made of rock of some kind. Slag aggregate is different. Slag is basically the waste left over after a metal is smelted to separate it from the ore it naturally occurs in. The pure metal is removed, and the collection of compounds left over is slag. An oversimplified description would be that iron ore goes into the process and separated steel and slag come out. The steel slag aggregate was supplied by South Shore Slag, a division of Beemsterboer Slag Corp., Hammond, Ind.

"It looks sort of like lava, but denser," Bill Pine, quality control director of asphalt technology at Heritage Construction and Materials, told ROADS & BRIDGES. "It won't have as many pores, but it's generally very black in color or dark gray."

Regular roadway asphalt in Illinois, for example, often uses aggregate of limestone or dolomitic limestone, which has a white color, so with age and wear, the surface turns almost white. The steel slag's dark color means that even when the asphalt film has worn off the aggregate at the surface of the pavement, the Indianapolis racetrack will remain a pristine dark gray or black.

The new paving project would provide added grip for the Indy GP and an altered configuration for MotoGP, the premier worldwide class of motorcycle racing.

The enhanced friction provided by the steel slag aggregate is especially good for the MotoGP motorcycles. Modern prototype racing motorcycles lean into turns at up to 60°. MotoGP will hit the track—racing counterclockwise, like the Indy 500—on Aug. 10, 2014.

The Indianapolis Motor Speedway wanted to alter the track configuration for the motorcycle races, so the paving was not a matter of simply resurfacing an existing track. In places where there was existing track, MAMCO milled off the existing pavement, and Milestone Contractors L.P. laid 3.5 in. of intermediate course and 1.5 in. of racing surface. Where Milestone had to create new pavement for the reconfigured MotoGP course, they laid a base course prior to the intermediate and surface courses.

In all, Milestone laid 4,700 tons of 19-mm NMAS base course, 14,800 tons of 19-mm NMAS intermediate course and 8,400 tons of 9.5-mm NMAS steel-slag surface course.

The paving crews finished just in time, too.

Racing the cold

"As we finished the road course on the 19th [of November 2013], we had a fair amount of snow on the 20th," Scott Cornelius, vice president and area manager at Milestone, told ROADS & BRIDGES. "Winter set in at that point and really didn't let up until about May of this year, it seemed like."

Cornelius said the cold weather did not really affect the asphalt material, but it meant the paving crews had to be more aware of the weather and "keep things buttoned up,

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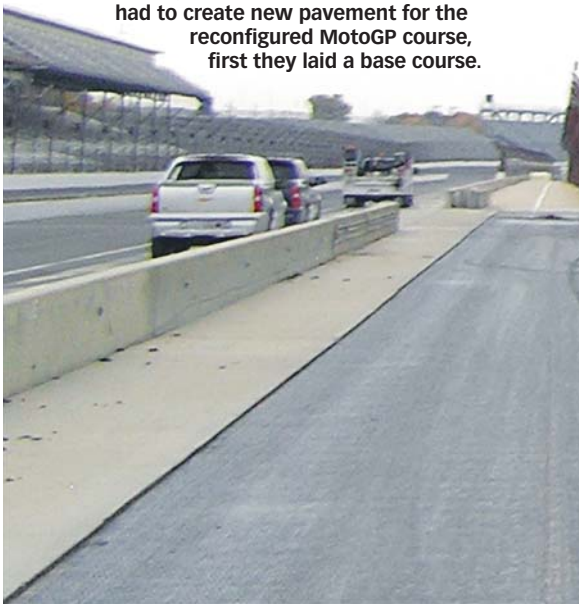

keep the rollers tight to the paver and make sure you're getting compaction before the temperature falls. The rate of cooling would be significantly higher in those cooler air temperatures and wind than it would be on a typical summer day."

Conditions inside the speedway can be windy, and the wind can be different from one turn to another.

The climate of Indianapolis also affected the type of binder Milestone Contractors could use. Racing pavement is prone to excessive heating from sunshine and hot tires, so it is prone to raveling. Typically, racetrack pavers counter the raveling problem by raising the softening point of the liquid asphalt. Heritage had to balance the need for a harder liquid asphalt with the need to prevent cracking in the cold winters of the Midwest. The company started with a PG 64-22 neat asphalt and modified it with polymers to reach the final PG 76-22 liquid used in the pavement.

"Raising the softening point and making the asphalt stiffer at high temperatures is used

Fact Finder

When a metallic ore is smelted, a furnace heats it to the metal's melting point. The pure metal can then be poured off, and the collection of waste compounds left over is slag.

to resist shear distress, where the mix wants to shove and tear under high lateral force," Pine explained. "But if you get the softening point too high and use an asphalt cement that's too stiff, so you don't have any concerns with shear distress, when it's subjected to winter conditions, you can have low-temperature cracking. So there's a balancing act, just like there is on any of our pavements."

Milestone could not get started milling until Oct. 9, 2013.

"We worked extended hours, and we worked seven days a week," Cornelius said. "We didn't want to pass up any opportunity to work in favorable weather, and we knew those opportunities were going to be limited during that time period. If we could be paving, we were paving."

Training for the race

Milestone paved in four lanes without transverse joints except where the MotoGP course tied into the oval or transitioned to the new IndyCar course. On the longest stretches, they could lay one lift of a lane and run two profilograph traces in a day. The paving train used a Roadtec SB2500D material transfer device and a Roadtec RP195E track paver with a vibrating screed to get compaction started, followed closely by two Caterpillar CB54 XW rollers to accomplish the breakdown function, another Cat CB54 XW to perform the intermediate compaction and a Hamm HD120OV oscillating roller to finish compaction. They achieved their target average density of 94% of the theoretical maximum.

A very consistent mix and close attention to detail achieved a very smooth surface, according to Cornelius, starting with a uniform gradation from stockpile to plant to remixing in the material transfer device to the back of the screed and then a consistent rolling pattern. Milestone had quality-control personnel at the plant and at the jobsite throughout the day to check mixture properties.

"There were really two courses that we were working on," Cornelius said. "We were working on the existing MotoGP course, which is what we paved last, and then you had all the new alignments for the IndyCar course, all these short pulls. We pulled those first and then trimmed those edges off and then pulled four uniform lanes from one end to the other for the MotoGP course."

Before any of the paving started, the curbs were removed from around the existing track by Indy Earthworks, which also did the excavation for the new bits of track. The paving operation was then free to find the best level, using computerized grade control and a 30-ft ski, rather than trying to match abutting surfaces.

"It's really somewhat of a traveling stringline," Cornelius said. "Rather than having a fixed string that it's touching, it's actually reading the existing pavement, averaging what it's reading over a distance and then applying the thickness of the mat to what it's averaged."

The IndyCar show went from green flag to checkers without any pavement-related hitches. A more strenuous test might come in August when the motorcycles zoom down the front straight and, instead of turning in to follow the oval, take a sharper turn onto the infield. Turns 2 and 3 form a tight 180° that should give the asphalt a hard shove. The motorcycles will be leaning hard over, and the asphalt will have to resist the shear forces with all the metaphorical steel it has in it. **R&B**

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