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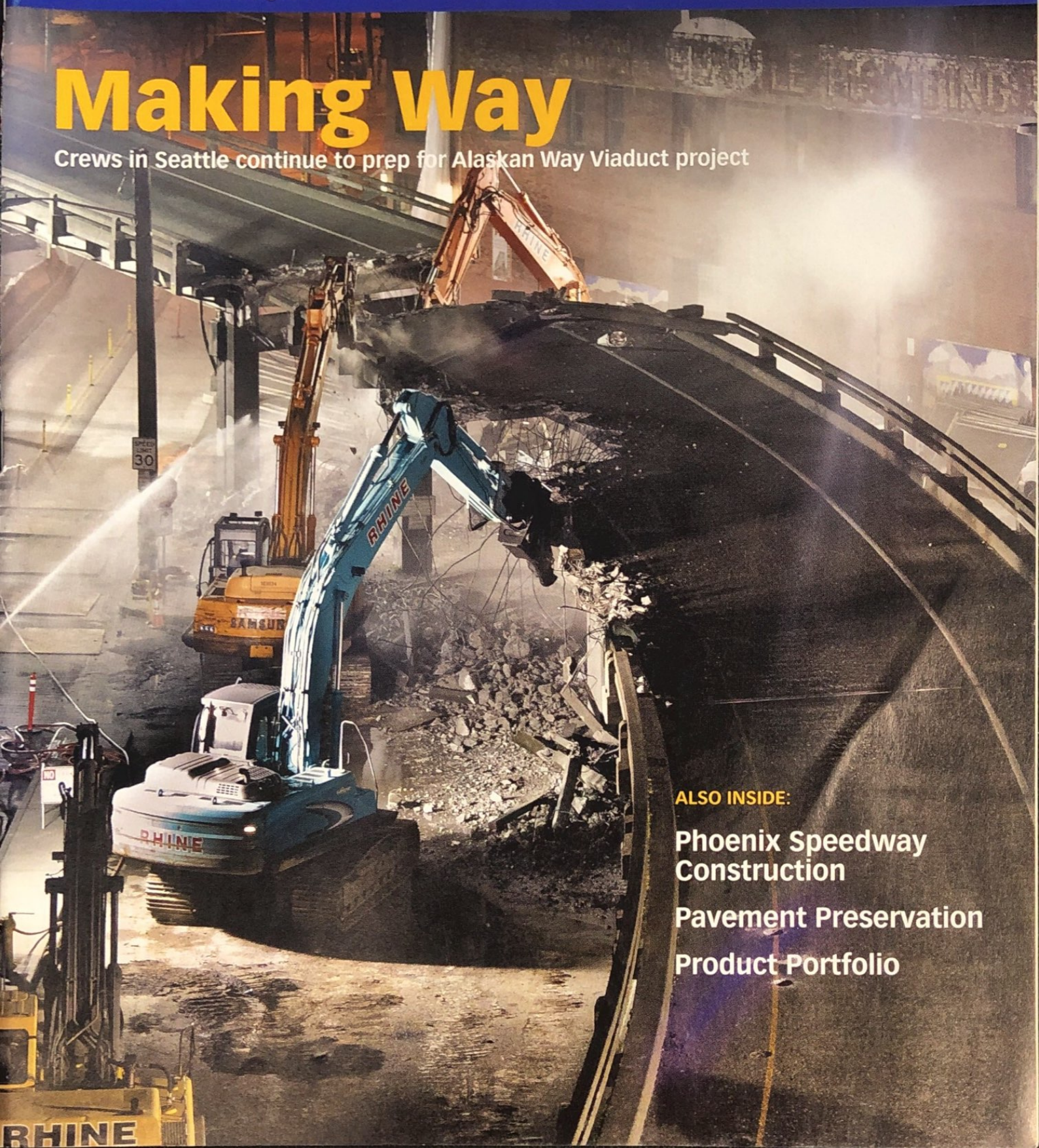

Making Way

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Managing Editor

Drive by me

Repaving at Phoenix Raceway should encourage side-by-side racing

On a highway, driving side by side is nothing noteworthy. On the banked turns of a NASCAR oval, side-by-side driving is the subject of careful engineering.

The pavement at Phoenix International Raceway had reached the end of its useful life, so the racetrack's owner, International Speedway Corp. (ISC), investigated whether there were any changes that should be made to the facility while replacing the asphalt.

"In Phoenix, the overriding consensus was that we needed to make sure that we promoted side-by-side, competitive racing from the very first race after the repave," Bill Braniff, P.E., senior director of construction for ISC Design & Development, told ROADS & BRIDGES. ISC Design & Development (formerly North American Testing Co.) is the in-house design and construction department for ISC.

On a freshly paved track with banking at a constant angle from the inside to the outside of the track, physics usually limits the race cars to one fastest path, or racing line, around the circuit.

"Oftentimes, on a uniformly banked track, there's one quickest way around the track, and that's what these professionals drive," said Braniff. "They do that for so long that eventually the asphalt cement wears off the surface of the aggregate, and the aggregate begins to polish. At that point in time it becomes advantageous for a driver to move a little bit further up the track, so he's driving a little bit further distance, but he gets a little more grip, so he can go faster."

ISC's solution to the single-line racetrack was to create variable banking at Phoenix International Raceway. Spectators may not notice, because the banking at Phoenix is flatter than some other NASCAR venues. The turns have banking of only about 11° in Turns 1 and 2 and about 9° in Turns 3 and 4. The difference between the banking on the inside and on the outside will be only 1° or 2°.

Slightly steeper banking on the outside line means a car can go a little faster and challenge cars on the inside line. If ISC's computer modeling is correct, Phoenix should see

side-by-side racing from the first race on the new surface.

Eventually the asphalt cement will wear off of the stones at the surface of the asphalt, but the stones ISC uses in the asphalt mix will be hard enough to resist polishing, so they will retain their friction and give the race cars more grip.

"We want the coefficient of friction to go down very gradually," Braniff said. "That's why at our tracks we use granite" or some other hard aggregate.

Because Phoenix is a fairly flat racetrack and because the race cars have plenty of reserve horsepower, the asphalt is subjected to extreme lateral forces. While in a turn, the cars push the asphalt up the track, and at Phoenix, the cars are almost always in a turn.

Power on the side

"At a track like Phoenix, a guy's either on the gas, accelerating with that tire trying to grip so it doesn't spin and imparting a lot of force onto the pavement," Braniff explained, "or he's hitting the brakes, locking it up as he gets into the turn, where again the pavement needs to resist that shoving."

Shoving is one of the primary differences between racetrack pavement and highway pavement. The others are heat and smoothness.

Racing tires build up a lot of heat, and they dissipate that heat partly through the track surface. The asphalt has to be able to withstand extreme heat without melting, especially in a climate like the desert of Phoenix. ISC will be using a PG 82-22 liquid asphalt for the new pavement at Phoenix.

The final details of the Phoenix asphalt mix are not yet settled, but Braniff said the pavement would consist of a 4-in. aggregate base course of crushed rock. Over that will be a 2-in. asphalt base course, a 1.5-in. leveling course and a 1.5-in. wearing course. The nominal largest aggregate size will be ¾ in. in the base course, ½ in. in the leveling course and ⅜ in. in the wearing course.

"We don't need three layers or 5 in. for a structural number," said Braniff. "What that gains us is that the more layers you put down, the smoother you can make the pavement." Braniff said the smoothness specification for the racetrack was about 50% stricter than the typical specification for a highway.

To make the pavement smooth at Phoenix, ISC uses GPS or a similar system to rough-grade the aggregate base course and then uses standard surveying methods to do fine grading. They also survey each asphalt course to see, for example, what cuts or fills are needed for the leveling course.

Smooth running

"You want it so on the wearing course you're not adjusting for thickness or grade or anything," Braniff said. "You're just setting it up and letting the automation of the paver take over as you drive around the track and do one slow lap." Of course, they will schedule deliveries of asphalt so the paver never has to stop: "Every time you stop the paver, you introduce an opportunity to have a bump or a dip."

The track will still have one unavoidable transverse joint, but ISC will probably position that on the backstretch, where the track is flatter, and angle it so a race car's wheels will reach it in a staggered manner.

The paving contractor, Ajax Paving, at press time was still working out its quality control plan for the job, but Martin Flugger, director of engineering for ISC Design & Development, outlined the likely components. He said probably an end-dump truck at the bottom of the racetrack would dump hot-mix asphalt (HMA) into a material transfer device, which would convey the HMA to another device that would convey the HMA up the banking to the hopper of a Vogele paver. The paver would place the mix on the track and use a high-density screed to initially compact it. Then at least two rollers will perform the breakdown and finish compaction to a target density of 94% of the theoretical maximum density.

The compaction target is a little denser for a racetrack than for a typical highway, Flugger told Roads & Bridges, because the racetrack owner cannot count on any further compaction action from traffic on the pavement.

"What we get on day one is pretty much what we're going to live with for the life of the pavement," Flugger said.

Ajax planned to start paving in early June. Another result of not being as steeply banked as some other NASCAR ovals is that Ajax will not need to take extraordinary measures to keep the paver and other machinery from sliding down the banking. Up to about 18°, said Braniff, the paving equipment can hold itself on the bank without extra support.

Underground crossing

One minor complication to ensuring the track is smooth is the two new tunnels ISC is building under the track. The two pedestrian tunnels, one under Turn 1 and one under Turn 2, will give spectators more chances to walk from outside the track to the infield. Until now, there was only one vehicular tunnel, which would also accommodate pedestrians, under Turn 4.

"We open-cut the track," Braniff said. "When we backfill it, we're very careful with our materials, maybe backfill it

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ISC has built two new pedestrian tunnels under the Phoenix track, one under Turn 1 and one under Turn 2. They open-cut the track and then backfilled around the tunnnel.

with a lean concrete mix, just to make sure you don't get any settlement around the tunnel."

ISC dug a tunnel a few years ago under Daytona International Speedway, also owned by ISC, using the same techniques. At Daytona, the contractor spread a geotextile over the tunnel section to resist differential settlement.

ISC also is currently working on a tunnel beneath Michigan International Speedway, another of the baker's dozen racetracks owned by ISC.

The work at Michigan is just getting started, according to Flugger, and includes resurfacing the track but not removing the pavement all the way down to the dirt.

Removing only a portion of the pavement can be harder than digging it all out, said Flugger.

"They usually have a lot of settlement in them, so when you go to repave the track, you're not just milling off 2 or 3 in. and then you put another 2 or 3 in.

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down. You've got a variable depth to the milling process to try and smooth the track out so when you pave it in, it's extremely smooth and fast, just the way they want it to be. When the mill first gets into the ground, you always wonder what you're going to see."

The deeper pavement also may have problems related to advanced age, since it may be left over from an earlier resurfacing or patching job.

The main reason for repaving Michigan is to prevent water from getting into the pavement.

"The biggest thing that we can do for Michigan to help with the problems with weeping is to repave the track, because it reseals the surface," Flugger said. "Right now the majority of their water that they tend to have issues with is coming from rain getting into the cracks that are open in the track. And then it just gets down into the pavement structure and eventually has to work its way out. Once you repave the surface it tends to seal everything up, and the water sheds off of it."

Drainage is a concern at Phoenix, too, even though the raceway is in the desert. ISC is planning to install drainage pipe and inlets in the apron area at the bottom of the track to collect rainwater runoff and disperse it in the infield. The company also is pouring a new exterior crash wall around a new dogleg configuration, so they have to consider how to prevent rainwater from getting under the track from the outside and washing away the sub-base.

Finishing the new shape

The new crash wall is needed because ISC is moving the dogleg between Turns 2 and 3 out 95 ft, another modification designed to encourage more exciting side-by-side racing. ISC also is raising the backstretch a couple of feet to make it easier for spectators at the front stretch to see over the RVs and other vehicles in the infield. The company also is going to widen the front stretch 10 ft and reconfigure the pit road. In all, the crews moved about 70,000 cu yd of earth, supervised by general contractor Howard S. Wright, which is overseeing the construction of the entire project.

The tunneling work is now completed at Phoenix as is the rough grading of the new configuration. Once the new exterior crash wall is finished, the aggregate base can be spread and prepared for paving.

The first event at Phoenix after the reconstruction is the NASCAR Sprint Cup Kobalt Tools 500, opening Nov. 10, but ISC expects to have cars on the track the first week of September. The Kobalt Tools 500 is the semifinal race in the Chase for the Sprint Cup.

If ISC's computer modeling is correct, the Kobalt Tools 500 should be an exciting race with plenty of side-by-side action. R&B

For more information about this topic, check out the Asphalt Roads Zone at www.roadsbridges.com.