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Talladega Superspeedway: Repaving an Icon

Work Zone Safety – It Doesn't Happen By Accident

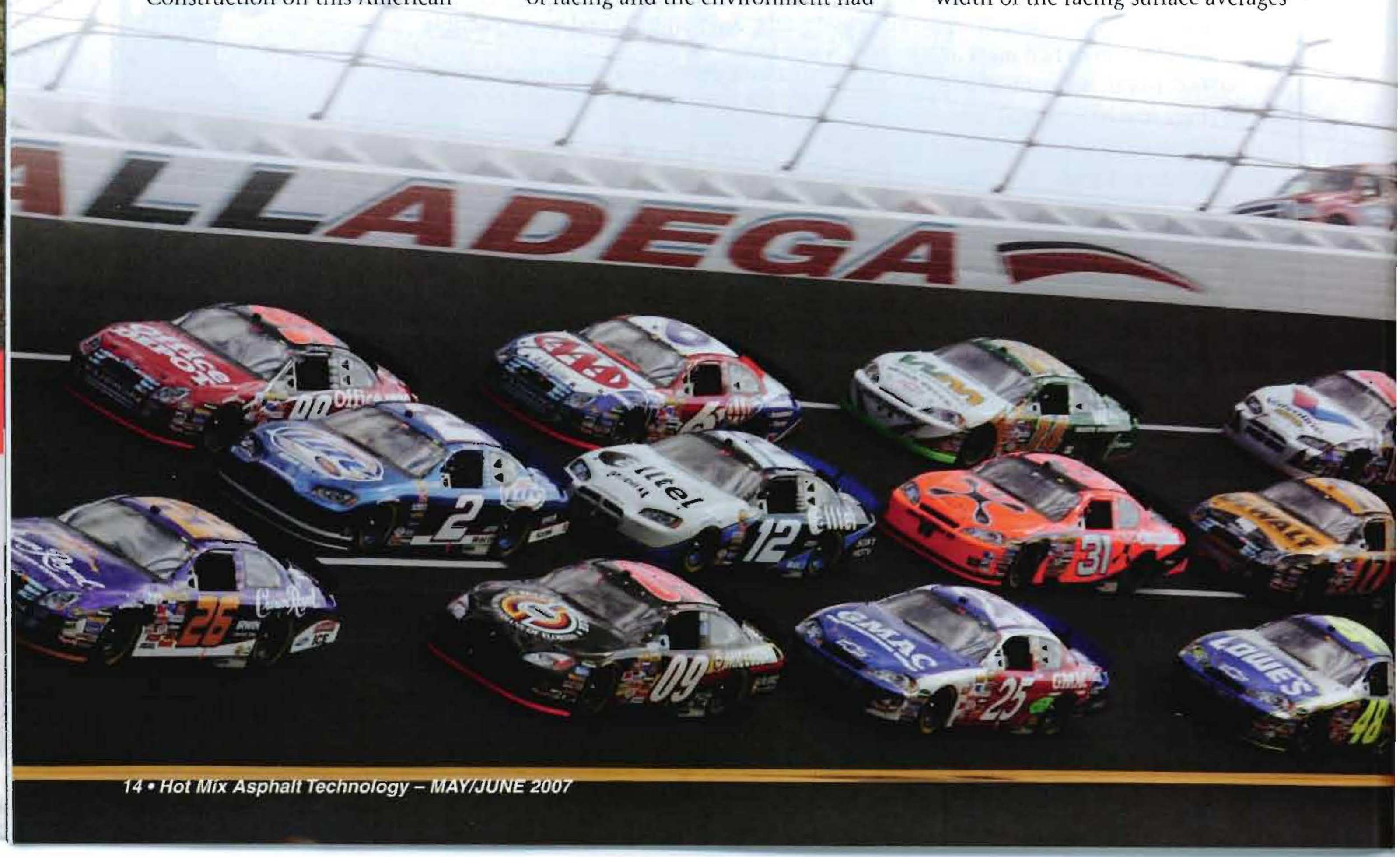
Talladega Superspe
a Fast Track for Fast Cars

By Brian Prowell, P.E.

Talladega Superspeedway is touted as NASCAR's most competitive track. More than 30 years of racing has provided fans and drivers alike with many heart-pounding thrills and breathtaking finishes. To guarantee continued excitement for fans and a smooth ride for drivers, International Speedway Corporation (ISC), the owner of the track, decided that the track needed a thorough rehabilitation.

Construction on this American icon of racing began in 1968 by Moss-Thornton Construction of Birmingham, Ala. The first race was held in September of 1969. Although the track was resurfaced immediately after that first race, it was not paved again until 1979, when a 1.5- inch overlay was placed by the Ashland-Warren Company. That 1979 overlay proved to be durable, but in 2005 ISC announced that the track would be resurfaced immediately following the May 2006 race. Twenty-six years of racing and the environment had resulted in numerous age related cracks and the curve embankments had sloughed in places causing roughness. The Talladega staff had been diligent about their preventive maintenance, to the point that the crack sealant was evident even on video games representing the track!

Talladega is a 2.66 mile long tri-oval. The maximum banking in Turns 1 through 4 is 33 degrees, with maximum 18 degree banking in the front stretch tri-oval. The pavement width of the racing surface averages



edway Construction:

Brian Prowell of NCAT checks the density of paving. NCAT personnel verified mix designs, performed QA testing, and monitored density during construction.

The mill and overlay project at the speedway required some 50,000 tons of asphalt and a total of five different mixes. The project emphasized smoothness, durability and proper drainage for the track.

60 feet on the front straight and 48 feet in the turns, plus a 12-foot apron. The scope of the repaving project included reconstruction of Turns 1 through 4 from the subgrade up and a mill and overlay of the tri-oval, back straight, pit road and skid pad or run-off areas surrounding the track. Pit road was also widened and additional skid pad area constructed along the back straightaway. Finally, concrete pit stalls were installed.

The schedule for the project was tight. Demolition could begin on May 2, 2006, the day after the Aaron's 499 and needed to be completed before September 20 to allow tire tests prior to the October 8 UAW-Ford 500. The design-build contract was awarded to Sunmount of Justin, Texas. Sunmount has paved a number of NASCAR speedways, and its experience was invaluable to the project.

Like any good project, there was upfront communication among all of the parties, including the Talladega staff, ISC Engineers, the contractor and contractor's consulting engineers, and the owner's consultants. Weekly telephone conferences, which later were held on site, were initiated in January 2006 and continued throughout the project. The meetings were held to discuss fabrication of specialized equipment, materials selection, mix designs, and equipment mobilization. The goal was to start the construction process on May 2.

Sunmount set up a hot-mix drum plant on the site in February 2006 to be dedicated to the project. The mix designs were verified by the National Center for Asphalt Technology (NCAT), working through the Center for Advanced Motorsports Testing and Research (CAMSTAR). Test sections were required for all of the mix designs. The first test sections were constructed in early April 2006.

Reconstruction in the curves consisted of 6 inches of cement treated aggregate base (CTB) plus 5 inches of HMA laid down in three layers. The tri-oval and back straight were milled to a depth of 3 inches and resurfaced with two 1.5-inch thick HMA layers. The skid pads were milled to a depth of 1.5 inches and resurfaced with a single HMA layer.

The typical failure modes of a racetrack are both the same and different from a highway pavement. Drainage is extremely important. The asphalt surface for a highway pavement is typically designed to prevent rutting. On a racetrack, raveling is the most common failure mode. The tires used on race cars consist of a very sticky rubber compound. The heat generated by the tires can raise temperatures on the surface of the pavement above 160°F. The combined forces can literally rip aggregates out of the pavement surface if the mix is not properly designed. A good bond between layers is required to prevent shoving under lateral loading. Finally, durability is always a concern. Racetracks consist of large paved expanses, many areas of which receive little traffic.

The two biggest challenges of the whole project were paving on the 33 degree banking and achieving the desired smoothness.

A total of five different HMA mixes were specified for the project. The base mix was a 12.5 mm nominal maximum aggregate size (NMAS) mixture with a polymer modified PG 76-22 binder. A stiffer PG 82-22 was used for the leveling and wearing courses. The binder specification includes a number of "PG+" specifications to help ensure the desired level of modification. The contractor had a choice of either a 9.5 mm or 12.5 mm NMAS mixture for the leveling course. Locally available limestone aggregates were used for the base, leveling and, wearing course on the skid pads.

What makes a good racing surface? A relatively fine mix composed of a polish-resistant aggregate with relatively high asphalt content produced using a very stiff binder appropriate for the climate. The racing surface was a 9.5 mm NMAS mixture produced with Granite #89 stone imported from Georgia and local limestone fine aggregate. The gradation is a balance between the right volumetric properties and the desired texture. Too coarse of a mix might result in excessive raveling and too fine of a mix might result in inadequate tire wear (potentially resulting in heat buildup). A 75-blow Marshall compaction effort was used for all of the mixes. All of the mixes included 1 percent hydrated lime for moisture resistance.

Demolition began with the removal of the barrier and the catch fences in the turns. The barrier wall consists of a hollow steel impact surface, separated from the concrete crash wall by a series of polystyrene blocks. Nylon straps are used to anchor the system to the concrete wall. The system is designed to dissipate energy in the event of a crash. Each piece of the barrier was carefully numbered as it was removed for replacement after the paving was complete.

The existing pavement in the turns was removed with an excavator, while a milling machine was used on the front and back straightaway. Probably the two biggest challenges of the whole project were paving on the 33 degree banking and achieving the desired smoothness. Typically, you can pave on slopes up to around 18 degrees without supporting the equipment. Up to about 24 degrees, equipment can be supported from below using a stiff-arm system. However, over 24 degrees, the equipment should be supported from above. This was complicated by the existing concrete crash wall which was to remain in place.

Danny James, who works for Virginia Paving, designed the specialized equipment to support the equipment used on the 33-degree curves. First the reclaimed asphalt pavement from the track was crushed and used to build up the existing ring road around the curves to the top of the crash wall. James designed a hydraulic arm mounted to a dozer, which could reach over the wall. A cable system was attached to the equipment on the embankment. The system was designed such that the roller operator could roll successive passes across the width of the mat, compacting the mix without the roller sliding downward to the infield. Each piece of equipment was supported by its own dozer. Coordination between the operator of the bulldozer and the operator of the equipment on the embankment was essential, particularly when a roller, grader, or milling machine was working on the curves. A water tank was mounted on one dozer to supply the roller.

The north and south turns have a maximum banking of 33 degrees, which meant the paving crew needed specialized equipment to do their jobs properly.

Sunmount is a veteran contractor who knows how to use good paving practices to produce a smooth pavement, but on the curves grade plays a significant role in the overall smoothness. The paving team desired to keep the character that made Talladega an icon while smoothing out the bumps that had developed from the sloughing embankment. The grades needed to be smoothed in essentially three dimensions in order to produce a smooth ride through the curves. A team of surveyors worked throughout the summer to set and check the grades. Although the paver was equipped to accept GPS input, Sunmount resorted to more conventional techniques when placing the base. String lines were set to pave the base and leveling courses in three passes. Survey points were set every 10 feet in the curves. Because of the degree of banking, the surveyors had to work off man lifts to place the points. A 40-foot-long ski was used to place the surface course. The ski included a bridge to reference off the mat directly behind the screed, which theoretically is perfectly smooth, using non-contact sensors.

The mix was placed with a paver using a high-density or tamping-bar screed. The high- density screed offers a couple of advantages for a racetrack: first it minimizes roll down to about 1/8 inch per inch of mix being placed which improves smoothness, and second it produces a higher degree of density immediately behind the screed. The HMA was placed at approximately 10-12 feet per minute. The surface mix was placed such that there would only be two transverse joints in the track, one each at the entrance of Turns 1 and 3. This resulted in some long paving days. The base mix was paved from the bottom up, and the leveling and wearing courses from the top down. Joints were staggered between lifts.

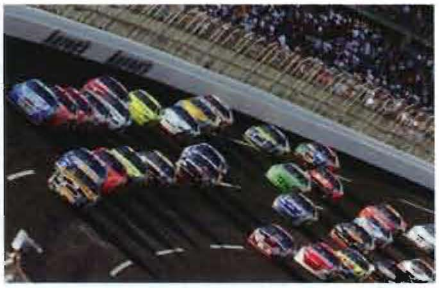
The mix was compacted with a single roller in the curves. An additional small roller was added to the front and back stretch. One of the challenges on a racetrack is compacting the mix up against the crash wall. The crash wall is not perpendicular to the surface of the track, but rather tilted a few degrees inward. Sunmount's solution to this problem was to mount a smaller diameter auxiliary roller on a hydraulic arm that could get closer to the wall.

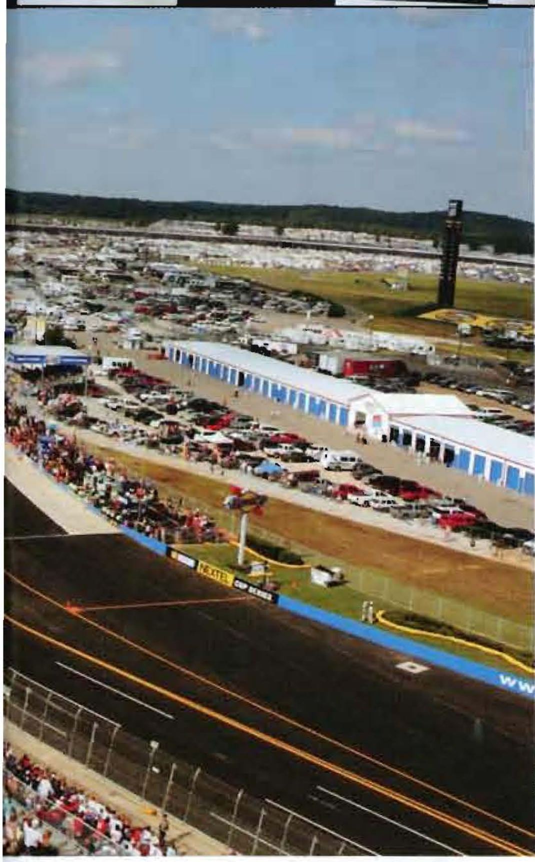
The unconfined edge of the longitudinal joints was cut back using a cutting wheel mounted on a grader while the mix was still plastic. The cutting wheel was angled to help push the mix away from the mat. The slight angle produced a nice cove fillet at the bottom of the cut edge instead of a sharp 90-degree angle, which would be harder to compact mix into. On the surface course, the cut face was tacked with joint sealant prior to placing the next pass.

Quality control and quality assurance density tests were performed with nuclear density gauges calibrated to cores. Acceptance of the base and leveling course was based on 10 random cores taken from each day's production. Acceptance of the wearing course was based solely on nuclear density readings. The average in-place density for the wearing course was 94.2 percent of theoretical maximum.

Smoothness was measured on each lift with a high-speed inertial profiler. Where necessary, precision milling was used on the leveling course to correct grades prior to placing the wearing course. The smoothness specifications for the surface required a profile index with a 0.1-inch blanking band to be less than 8 inches per mile for each 0.1 mile increment. A bump specification was also included. The real test was a seat of the pants test at the end of the day.

What was most impressive about this project was the dedication and hard work of the paving team. The paving crew worked from July 4





through the completion of paving in September without a day off, sometimes 18 hours per day. If mix spilled on the ground in front of the paver, it was shoveled up quickly and without complaint. When paving the curves, one of the workers carried a backpack blower to blow crumbs from any excess material at the longitudinal joint off the mat before it was rolled in. If there was a problem, we worked together to solve it: contractor, owner, and consultants.

In total, approximately 50,000 tons of mix were placed during the

repave. Was it a success? In some respects we might not know for another 26 years, but first impressions were a resounding yes! Bill Braniff, North American Testing Company's (ISC's Engineering Group) Senior Director of Construction, stated, "Sunmount has once again demonstrated the tenacity and attention to detail that we have seen you exhibit on previous projects and we thank you for a job well done." During the drivers' meeting just before the start of the UAW-Ford 500, the drivers and crew chiefs showed their appreciation for the finished product by giving the Sunmount staff present a standing ovation.

Brian Prowell is the principal engineer for Advanced Material Services and formerly the Assistant Director for National Center for Asphalt Technology. **HMAT**