Road Surface Construction and Reinforcement

Baku FORMULA 1 Racetrack — Baku, Azerbaijan

The FORMULA 1 AZERBAIJAN GRAND PRIX has been held at the Baku City Circuit since 2016.

PROJECT INFORMATION

Project
Baku FORMULA 1 Racetrack
Baku, Azerbaijan

Project Category
Road surface construction and reinforcement

Date
2016

Simpson Strong-Tie Products
Carbophalt™ G 200/200 pre-bituminized asphalt pavement reinforcement grid

CHALLENGE

Design a reinforced but removable asphalt pavement for a new racetrack to overlay UNESCO World Heritage Site cobblestone.

SOLUTION

Apply an asphalt reinforcement grid designed to absorb high tensile forces around curves and breaking zones to prevent tearing and shoving.

RESULTS

The grid-reinforced asphalt pavement design met the temporary needs of the race and continues to provide a smooth, safe route for both racers and daily commuters.

BACKGROUND In 2016, the city of Baku inaugurated a new racetrack running through Icheri Sheher — a World Heritage Site

Icheri Sheher ("The Inner City"), the walled city of Baku, Azerbaijan, is the original, most venerable part of this ancient Silk Road capital on the Caspian Sea. It's renowned for structures built of cut limestone, including the 12th-century Maiden Tower (Giz Galasy). Icheri Sheher was declared a cultural and historical treasure in 1977, and in the year 2000 it was added to the UNESCO World Heritage Sites.

In 2013, planners decided to construct a motor racing street circuit through The Inner City. The new, 3.72mi (6km) Baku City Circuit was projected to be the fastest street circuit in the world at the time, and the second longest. It was originally designed to host the 2016 FORMULA 1 EUROPEAN GRAND PRIX and its support events.

THE CHALLENGE Design an asphalt structure that would be removable but could safely withstand forces exerted by high-speed vehicles

The old town center is intersected by numerous centuries-old cobblestone streets. In order not to jeopardize the site's World Heritage status, it was necessary to comply with UNESCO requirements that the racetrack could be dismantled after its use had ended, without leaving any damage or residue on these historic streets. This required spatial as well as mechanical separation between the asphalt structure of the racetrack and the cobblestone paving beneath. Realistically, this could best be accomplished by creating an intermediate layer of crushed gravel — a solution that brought its own challenges.

One of the identified challenges was a concern that the asphalt structure might decouple from the existing base. With speeds exceeding 220 mph (354 kph), very high G forces (up to 4.5 g) will be generated in all corners and braking zones. These forces could potentially cause tearing or shoving of the pavement because of the extreme loads exerted by the racing vehicles.

THE SOLUTION Reinforce curves and braking zones of the asphalt structure with Simpson Strong-Tie Carbophalt™ G 200/200 grids

To devise a solution, Hart Consult International GmbH, the Engineer of Record (EOR) commissioned with the planning and project management of the racetrack, turned to engineers from Simpson Strong-Tie. Working together, the two firms created a design to bolster the three-layer asphalt structure by applying 53,820 square feet (5,000 square meters) of Simpson Strong-Tie Carbophalt G 200/200 asphalt reinforcement grids in stress areas, such as curves and braking zones. These reinforcements would help distribute the racing vehicles' extreme loads over a larger area, thus preventing dangerous shoving or tearing of the pavement.

In such a design, the grid works because the reinforcement fibers are very stiff, with a high modulus of elasticity, giving them the tensile strength needed to absorb large tensile forces even at very low elongations. Moreover, a high bond of the fibers with the asphalt and a high mechanical bond between the asphalt layers are both necessary.

Carbophalt G 200/200 is a reinforcement grid made of carbon fibers oriented in both longitudinal and transverse directions. The extremely high elasticity modulus of the fibers (> 34,809 ksi [240,000 MPa]) gives the grid a tensile strength of 13.7 kip/ft (200 kN/m) at a maximum elongation of < 1.5%. Due to its adaptable grid structure and bitumen saturation, a very high bond between the fibers and the asphalt is created as well, which means that the fibers will be activated immediately when forces act on them. This makes Carbophalt G 200/200 ideal for reinforcing asphalt structures subject to the highest loads, as would be the case with this tightly winding racetrack.

Simpson Strong-Tie engineers worked very closely with the EOR to ensure that calculations of the reinforcement's suitability and performance were reliable. Simpson's extensive expertise in the field of static concrete and asphalt reinforcement, combined with Hart Consult International's expertise in the field of driving dynamics and conditions, made possible the precise details of the design.

THE RESULTS The structure continues to demonstrate its strength and stability, ensuring safety for racecars and city traffic long after installation

The solution has been successful well beyond the project owners' original expectations; what was initially planned as a temporary measure has now been proving its worth for a long time. After hosting the 2016 FORMULA 1 EUROPEAN GRAND PRIX, the track has hosted the annual FORMULA 1 AZERBAIJAN GRAND PRIX since 2017, along with annual Fédération Internationale de l'Automobile (FIA) F2 races. During that time, the Carbophalt-reinforced asphalt course has not only been protecting the lives of racecar drivers, but providing a safe, smooth road for heavy daily traffic in Baku as well.

MORE INFO

For complete information regarding specific products suitable to your unique situation or condition, please visit **strongtie.com/asphalt** or call your local Simpson Strong-Tie Pavement Specialist at **(800) 999-5099**.

© 2023 Simpson Strong-Tie Company Inc. • P.O. Box 10789, Pleasanton, CA 94588