ALASKA STYMIES STUDDED TIRES

by Tom Kuennen
The problem exists throughout the Pacific Northwest. Abaza reported: “The cost of crashes and other safety aspects caused by studded tire sales and stud installations, not considering the cost of crashes and other safety aspects caused by studded tire sales and stud installations, is estimated to be $13.7 million, 42 times the state’s fees [$318,000 annually] from studded tire sales.”

In North America, typical SBS-modified asphalt binders contain 2 to 4 percent SBS modifier. In contrast, the stringent, performance-related specifications for HMA usually requires 7.5 to 8 percent SBS. HMA binders result in a significantly more durable pavement with a rubber-like flexibility to recover from the indentations created by the tires, while retaining mix workability during placement. In milder climates, research and experience have shown that HMA binders result in mixtures with much greater resistance to rutting and fatigue cracking than other binders.

“If HMA is our term for a highly modified asphalt,” says Bob Kluttz, Senior Scientist, Research and Development, Kraton. “Other states will call it high modulus, high polymer (HP). With Kraton D0243, you’re going from predominantly an asphalt phase with polymer dispersed in it to predominantly a polymer phase with asphalt. With it, we can change the blend from rubber-modified asphalt to asphalt-modified rubber. That is, the mix goes from a discontinuous to a continuous polymer phase, with very different physical properties resulting from that.”

Lab tests confirm these performance properties, Kluttz says. The Pratt test, Alaska Test Method 420, for studded tire damage was originally developed in the Nordic countries and is standardized as EN12697-16 in the European Committee for Standardization (hence the standard SI units). Test specimens are 100 mm × 139 mm in diameter and 30 mm (1.2 in.) thick and are tested at 5 °C at 41.6 mm/s. The specimen is loaded in the test device and covered with 40 stainless steel spheres 12 mm (0.47 in.) in diameter. The test chamber is oscillated at a stroke of 43 mm (1.7 in) at a frequency of 190 strikes per minute for a period of 15 minutes.

The wheel paths look dark much like the Pratt test specimens, indicating that roughly the same behavior is occurring in the laboratory and in the field. The Alaska DOT&PF is pleased with the performance and is specifying more projects with modified PG 64-40 binder and hard aggregates, designated as Hot Mix Asphalt, Type VH by Alaska DOT&PF.

“Since they have been trying for years to come up with a solution for this kind of damage, they came to us in 2012 and said, ‘Hey, do you have any ideas about how to address this damage with HIMA? Do you think it would help?’”

So in 2015 – in downtown Anchorage – a PG 64-40 E HIMA binder was used for the first time in a Superpave mix that incorporated hard aggregates. HIMA mix was placed on two busy avenues, one-way streets in downtown Anchorage. This project was a standard street resurfacing with a 1 in. (25 mm) mill and 2 in. (50 mm) fill. The HIMA overlay was placed on 5th and 6th Avenues and cross streets, with traffic ranging from 10,000 to 15,000 vehicles per day.

The road damage caused by studded tires reduces road safety for all motorists when water collects in pavement ruts caused by studded tires, and creates dangerous driving conditions like hydroplaning and increased splash and spray. Rutting caused by studded tire wear is a serious problem in the American Pacific Northwest, costing the states of Oregon, Washington and Alaska millions of dollars annually in damage to both asphalt and Portland cement concrete roads.

The Alaska Department of Transportation and Public Facilities (DOT&PF) sponsored a study at the University of Alaska-Anchorage to estimate the costs of damage caused by studded tire wear to Alaskan highways. This included collecting data to determine the rate of rutting on different roadway classifications and for different vehicle types.

The research team found that rutting caused by wear from passenger cars using studded tires is worse than deformation due to truck axle loads. Results show higher average wear rates due to studded passenger vehicles on freeways (0.0116 inches per 100,000 studded vehicles) than the average rut rates due to heavy wheel loads (0.0047 inches per 100,000 trucks), according to Survey and Economic Analysis of Pavement Impacts from Studded Tire Use in Alaska (2019), by Osamu Abaza, Ph.D., C. Eng., University of Alaska-Anchorage.

Also, higher speeds worsen studded tire rutting. Abaza found lower average wear rates on arterial and collector roads (0.0052 in. and 0.0043 in. per 100,000 studded vehicles, respectively), than on highways that have higher speed limits.

“The actual damage cost associated with studded tires statewide was found to be $13.7 million, 42 times the state’s fees [$318,000 annually] from studded tire sales and stud installations, not considering the cost of crashes and other safety aspects caused by studded tires,” Abaza found. “In 2019, the estimated total cost of mitigating road damage from studded tire use in Alaska over the next 20 years will amount to $203.2 million.”

The problem exists throughout the Pacific Northwest. Abaza reported:

- Damage to pavements on Oregon state highways due to studded tires is estimated to be from $8 to $10 million annually.
- The road damage caused by studded tires reduces road safety for all motorists when water collects in pavement ruts caused by studded tires, and creates dangerous driving conditions like hydroplaning and increased splash and spray.
- “Rutting of pavements by studded tires is a huge issue in Alaska,” says Drew Pavey, State Pavement Management Engineer, Alaska DOT&PF.
- “It’s a regional issue, first,” says Steve Saboundjian, P.E., State Pavement Engineer. “We don’t have that studded tire distress in Fairbanks in the Northern region because of the climate, the materials or the hardness of rock. But when it comes to the Anchorage ‘bowel’ or Juneau or Ketchikan, it’s more prevalent. These are high-volume, high-traffic areas where the traffic impacts or hammer the pavement. Half of the state’s population is in the Anchorage area.
- “If you want to look at our region, the mass extent of our rutting concerns is from Willow to Anchorage and south down the Seward Peninsula,” says Mike Yerkes, P.E., Materials Group Chief, Pavement Engineer. “We don’t have that studded tire distress in the Fairbanks region because of the climate, the materials or the hardness of rock.”
- “What we saw with Prall testing was that the conventional material with asphalt. With it, we change the blend from rubber-modified asphalt to asphalt-modified rubber. That is, the mix goes from a discontinuous to a continuous polymer phase, with very different physical properties resulting from that.”
- “It depends on the ADT, speed of the traffic, ambient temperatures and type of mix,” Pavey says. “In some areas, we are seeing average wear rates of an eighth-inch a year.”
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**HIMA FOR HIGH-LEVEL ROADWAY**

The Alaska DOT&PF also is concerned about studded tire rutting on its high-level, higher-speed, higher-volume highways. Glenn Highway – which runs east of Anchorage toward Canada in a scenic setting – provided such a highway application, compared to the urban application downtown.

Due to studded tire wear, Glenn Highway has typically been resurfaced every six to seven years. "We generally say that the Glenn Highway ruts 1/8-in. a year," Yerkes says.

Earlier attempts on Glenn Highway (Alaska S.R. 1) to quell studded tire rutting did not perform as hoped. A hot mix asphalt surface using ground tire rubber and PG 64-34 asphalt binder was placed on the Glenn Highway in 2010. But in 2012, the average rut depth between Airport Heights and Hiland roads, being the most highly trafficked route in Alaska, was 0.32 in. (8.1 mm) after two winters of studded tire wear.

"We have been trying rubberized asphalt mixes," Yerkes says. "The rubber asphalt mixes have turned out less desirable than what we’re currently seeing with our current 64-40 hard aggregate mixes."

So following the successful performance of the 5th and 6th Avenues in Anchorage, Alaska DOT&PF specified the same PG 64E-40 HiMA binder grade for resurfacing of the Glenn Highway.

In 2017, the rubberized mix was milled and replaced with 2 in. (5 cm) of Hot Mix Asphalt, Type VH for resurfacing 15.2 miles (24.5 km) of Glenn Highway. Some 50,000 tons (45,000 mt) of Hot Mix Asphalt with PG 64-40 E HiMA binder and hard aggregate were placed. In 2019, the average wear on this Superpave mix between Airport Heights and Hiland roads was just 0.21 in. (5.3 mm) versus 0.32 in. (8.1 mm) of crumb rubber asphalt, both after two years of service.

Construction of the whole project went from late 2016 to early 2018. In-place densities greater than 95 percent were consistently achieved.